Reverse Logistic and Remanufacturing in automotive industry: the GKN Brazil Case.

KOETZ, André Luiz¹; KLIPPEL, Marcelo²; PAMPANELLI, Andréa Brasco³

Abstract number 002-0415


Keywords: Automotive Industry, Reverse Logistic, Remanufacturing.

Abstract

This article introduces the activities developed by GKN Brazil, an auto parts segment company, leadership in manufacturing of sideshafts parts to Brazilian automotive market. It demonstrates the actual stage of reverse logistic operations to collect, evaluate, stock and transportation of parts that are remanufactured at the industrial unit responsible by the fulfillment of almost totality of this Brazilian market. Also, it describes the specifics procedures took place at this industrial unit, from the movements, production processes, quality tests and fulfillment of international certifications and standards until the distribution to sale points at the domestic market. Finally, the authors comment the actual stage and establish the questions to further requirements of study and orientation to reverse logistic operations and remanufacturing, considering the advent of European legislation that treat the statements of manufacturers related to the destination of auto parts and automobiles at the end of useful life.

¹ Corresponding Author. Universidade do Vale do Rio dos Sinos – UNISINOS/PPG Administração, São Leopoldo, RS, Brazil. CAPES scholarship holder. alkoetz@hotmail.com

² Universidade do Vale do Rio dos Sinos – UNISINOS/PPG Administração, São Leopoldo, RS, Brazil. CAPES scholarship holder. marcelo@klippel.com.br

³ Universidade Federal do Rio Grande do Sul – UFRGS/PPG Engenharia da Produção, Porto Alegre, RS, Brazil. EMS Responsible at GKN do Brasil Ltda. andrea.pampanelli@br.add.gknplc.com
Introduction

This article is part of an ecodesign study at the automotive industry, being result from the pilot case study at one company of the steel supply chain. Starting at the steel suppliers it assumes that ends at the same place. (FIKSEL, 1996)

Adopt green product design (design for environment, ecodesign) and life-cycle assessment tools are possible implications to operations management, and understand their relations with suppliers and vertical integration, or facilities characteristics (including processes technologies, capacities, quality management, etc.) are topics of an extended agenda of research propositions, not only to the academy. (ANGELL and KLASSEN, 1999).

This specific case shows why still there is a delay in the cradle-to-cradle products life cycle, especially in the trajectory of constant velocity joints. The explanation resides at fact that some parts and components are remanufactured, returning to market and attempting one of suppositions of “green” production (that are reduction, re-use and recycling). (C.L.M., 1993)

Recovering used parts and being environmentally and social responsible by one side, and gaining profits in other, with internal culture development, adoption of new structural arrangements and processes, creation of reverse distribution channels and winning the auto parts market pre-disposition to refuge recovery products, besides to solve legal problems related to the second hand informal commerce that exists in Brazil, were part of the remanufacturing process that Steinhilper (1998) called “the ultimate form of recycling”.

Theoretical Background

Much time before the concept of Extended Producer Responsibility – EPR was adopted by the European Parliament in 2000 (EC, 2000) specifically to end-of-life vehicles, that is well defined
in Lindqvist (2000) (apud SPICER and JOHNSON, 2004), as “a policy principle to promote total life cycle environmental improvements of product systems by extending the responsibilities of the manufacturer of the product, and especially to the take-back, recycling and final disposal of the product”, GKN already had to do attempt what Kotler (1998) said about responsibilities of all post-sell activities, among thus that involves guarantees and spares at sales points, in a great nationwide distribution net, helping to know about the uses and destination of products after consumption, that were important to GKN to understand what happened with sideshafts in end-of-life vehicles or main reasons in case of substitutions.

The logistics efforts, mainly that responsible to increase profits by increasing the quality level of services to the customers (NOVAES, 2001), besides that grant it will be done at the minimal cost possible (BOWERSOX and CLOSS, 2001), were upgraded while the first thing that started to return by the logistic path was information.

This “end-to-start”, or inverse process was called reverse logistics by Luttwak (1971), and today is part of some authors described like a trend that is the reverse supply chain, where “smart manufacturers are designing efficient processes for reusing their products”. (GUIDE and VAN WASSENHOVE, 2002). While the first way where the normal distribution channels are well structured and organized, thanks to the great amount of money and competitiveness involved (KOTLER, 1998), the Reverse Distribution Channels for Recycling (BALLOU, 1993), or the way of the take-back path to profit, still are not.

How still there is no standard, the final purpose may be a good indicator to define and manage reverse channels and suppliers. Some authors classify this take-back in return of materials and regaining the workpiece (HORNEBER, 1995; GIUNTINI and ANDEL, 1995), that denote
different ways to understand the retrieve of used products. In practice, scrap will receive distinct attention than “second hand” parts at automotive industry, for example.

Seitz, Disney and Naim (2003) presented an idea of product life extension by the possibilities of remanufacturing, repair and re-use it by the ways of turn the original product “as good as new” in the first case, replacing bad components in the second and re-start to use, without modifications, the last one. They still explain about material life cycle extension by recycling, maintaining original material configuration, and reclaiming, where “some parts of the product are reclaimed and used in a renewal process”.

All activities that recover quality standards (involving those through machining, parts replacement, lubrication and package) and give the condition to turn a used or end-of-life product “as good as new” (FERRER and WHYBARK, 2000), are considered part of the remanufacturing process in this paper.

**Methodology**

This is a pilot case study to complain a multiple cases project at the steel supply chain in the automotive industry (YIN, 2001). Been exploratory in nature, this research had the triangulation of information coming from several fonts, like interviews focusing in environmental relations to product development, attempting to an ecodesign perspective, presenting the relations among different areas and philosophies of the same firm.

Individual in-depth interviews, with heads of departments and managers had pointed different perceptions about the necessity and value of the remanufacture structure, receiving new perspectives during a general meeting with all of them to treat the same subject.
While a non-participant observation, how a good way to get an overview of all issues involved and nominated at interviews, was possible to describe all process above, starting at the purchase and ending at the expedition department of constant velocity joints individually packed (different of a car-set, that has two pieces of each, to be used at front or rear position).

The first question of this study was to understand how the reverse logistic and remanufacturing process occurs at GKN. Another purpose was to know (if and how) product development activities took care about the remanufacturing processes issues in use at GKN. And the last one was to percept and to explain possible trends to this industry.

The Study Case

GKN Group is a global company that is focused on the automotive and aerospace sectors, operating in more than 30 countries and 30,000 employees. GKN Driveline, the largest division of the group, is responsible for design and production of driveline systems and components to the automotive industry, with a range that covers every application from entry level front wheel drive vehicles to the most sophisticated four wheel drive models, been the world leader in production of constant velocity sideshafts. (GKN DRIVELINE, 2003)

In Brazil it isn’t different. Established in 1974 as a joint venture, acquiring ATH - Albarus Transmissões Homocinéticas, a well known firm at the market, started your production supplying constant velocity joints for the Volkswagen Passat, and continued to grow supplying the original equipment and spares markets in Brazil and abroad.

Today, GKN Driveline supports the major automotive assembly plants in Brazil, with an impressive dominant share of the domestic market, that is mean almost 90 % of the vehicles
equipped with GKN sideshafts. It reflects the commitment to excellence and efforts of more than 1,400 employees at two plants of GKN Brazil, the original one, in Porto Alegre, and a facility at Charqueadas, that supplies hi-tech forged parts to the first. Besides it, a very well equipped laboratory with the latest technology provides testing and approvals of sideshafts and components for the entire South American market and vehicles assembled in Brazil and exported to several countries around the world.

While the company’s objective is to provide a “one-stop” service, focusing its entire capability on customers’ needs, and combining complete reliability with a pro-active approach to quality to ensure that the perfect product is always delivered just-in-time requirements.

But not only have these requirements to be accomplished. The Brazilian government started to regulate the automotive sector since 1960 decade, determining to recycle all used lubricant oil, which now may be called the first reverse logistic effort, an industry already well established today. Other legal rules include the obligation of all automakers to maintain spares of parts and systems ten years long after they launch a vehicle.

**The Reverse Logistic Process**

Besides the law, other legal reasons compelled GKN Brazil to adopt the reverse logistic first, and its remanufacture later. As the Brazilian market has many different local characteristics, like climate, road pavement, etc., the life cycles of products are different at each condition too. Outside state capitals and major cities, is normal to found vehicles with more than 25 years old still in use.
This supervened is possible thanks to a great second hand parts and components market, most of that coming from crashed and old vehicles, and sometimes, from refurbished or fixed parts. Conscious that security, responsibility, confidence, the reliability of the own trademark and money where being lost in legal causes thanks a sideshaft welded in a little workshop, GKN started to reclaim and remanufacture your products. At Brazil is possible to characterize different paths that used products flow, sometimes in an irregular market. To the used and end-of-life constant velocity joints of GKN, it seems like in the figure above.

Figure 1: the reverse flow of constant velocity joints to GKN (source: authors, based on interviews and observation).
How GKN had a sell structure to attend big but few clients, that were the first four automotive assembly plants in Brazil when started with reverse logistic, the first thing do to was to get the feedback and information along the spare and replacement parts market. Developing relationships with demanufacturers (here considered disassembly plants that dismantle vehicles) and moral agreements that each product that have conditions to be remanufactured will be acquired by GKN, and those that it is impossible to do it will be sold like scrap to raw material manufacturers.

Contacts and negotiations among little demanufactures (normally scrapyards) are made regionally (not only at each urban centers, like São Paulo or Rio de Janeiro, but non-urban areas too), by the official demanufacturered elected and audited by GKN.

Doing so, the first selection and disassembly process occur at each supplier of this reverse chain, maintaining supplies of used and end-of-life sideshafts of each model (of all range of cars). The purchase process starts when an order is emitted by GKN to the demanufacturers that acquire the specific type of product requested.

The necessity to balance returns with demand discussed by Guide (2000) in an exercise of “pragmatic experience”, like the market data, spares and supplies at retailers and residual life time of vehicles are suppositions.

Even today the reverse flow of parts (including the first step of the disassembly process, because not the entirely product is sent back, only the core metal parts are accepted, where bearings, rings, clips and rubber caps stay at origin) doesn’t have formal proceedings except that are fiscal and legal ones, but volume, package or inspection of these parts are not the same to each provider. Consequently this material and the supply area at GKN will not have the same organization those others ready to be delivered in a just in time system.
The Remanufacturing Process

The first arrangement was a new facility, with all structure like a little industry not at the same address of the GKN (neither the same firm). How costs and management demands were increased it was moved to Porto Alegre location unit, creating a “mini-plant” to this finality.

Each process below took place at single workstations, but all workers are able to do all tasks. Like Seitz, Disney and Naim (2003) described, large amounts of manual work are involved.

Maintaining stocks of one or two models of sideshafts, reducing area utilization that permit to store parts in a pavilion, experienced workforce disassembly if necessary and inspect the material, that is approved or not to be recovered. Unusable parts and eventual components are sorted out to recycling at raw material manufacturers.

After a chemical cleaning, a manually wash is made, that clean grease and dirt with hot water and “green detergents” in a close system. These parts are stored. The next operation is the surface recover (that increases internal dimensions and tolerances for bearings) by grinding machine that avoids fissures and scratches.

The sequence of work involves again inspection, with magna flux process. Each sideshaft is evaluated and those still have structural problems (like remainder fissures, for example) are collected for recycling too. Once it is approved the sequence involves re-build the top gearing and stock, waiting for re-assembly process.

The next task take place at the assembly station, where are added new components to the constant velocity joint, like bearings and rings. After all, the joint, the rubber cover and clips that are not assembled, are individually packet with grease (that comes from leftovers at normal fabrication, reducing losses) in a paperback box labeled GKN remanufactured product.
The entirely flow, showing which process observed in the case study:

- Demanufacturers first disassembly → Scrap
- Stock at GKN Brazil
- Manual disassembly and inspection → Scrap
- Chemical and manual cleaning → Effluent treatment
- Surface recovery → Residue
- Quality control at Magna Flux process
- Main gearing recovery
- Re-assembly with new components
- Individual package
- Expedition

Figure 2: the constant velocity joint remanufacture at GKN Brazil (source: authors, based on interviews and observation).

**Discussion and Conclusions**

A time that first implication and motivation to adopt the reverse logistic and remanufacturing at GKN were the legal issues, the resolution of these statements resulted in safety image improvement and market recognition, and eliminate legal costs referents to accidents occurred because the use of irregular second hand (and refurbished or fixed) parts and components. So were possible end legal demands and high costs thanks to the initiative of reclaiming products.
Besides it, the Brazilian automotive legislation classify the suspension kit as a high safety demanding system, with special considerations about international normalizations and certifications, including the constant velocity joints in these requirements. GKN Brazil posses’ national and international accreditations reflecting company’s commitment to quality and the reverse logistic and remanufacturing process reinforce also it client’s recognition.

But like presented as question of this case study, the other purpose was to know (if and how) product development activities took care about the remanufacturing processes issues in use at GKN. The observation and interviews with workers at the “mini-plant” demonstrated that maintain the “as good as new” quality level is possible because the original product was developed to accept the remanufacture process.

This workforce has to be able to work with many generations and models of products, needing to be very skilled while uses all set of machines in mostly manual process. Like remanufactured products are almost handmade products, high productivity levels can not be asked like to the original items, (SEITZ, DISNEY and NAIM, 2003) and costs are measured at the same way.

Old fashioned products (something more than 5 years) were designed to make possible two remanufactures, in accordance with the procedure described before. While the law determines the existence during 10 years of spares and replacement material, there was some logic in produce more robust products.

This point of view isn’t more a trend. The idea that reduction of raw materials, that means reduction of energy into the process of fabrication, and in consequence, the reduction of the final vehicle mass and reduction of fuel consumption had leading the projects of product designers and process engineers (FIKSEL, 1996) but the recover that was discussed until now will not be possible.
Just above already have an answer to the last question of the case study, trying to explain possible trends to this industry.

From 1986 a national regulation started the Automotive Pollution Control Program (PROCONVE), requiring the measurement and reduction of all vehicles emissions by the automotive industry. Systems like ignition and fuel admission changed in few years, others like catalytic converters changed immediately. (ANFAVEA, 2002)

Because this equipment that radiates head, at the Mercedes Benz Classe A model, built in Brazil, GKN needed to develop a constant velocity joint witch rubber cover had to be changed for a new material, a resistant thermoplastic, as well as the grease, because that one used decomposed under high temperatures. Today these modifications are the standards of new product.

These issues had decreed the end of the remanufacturing process at GKN Brazil, although the reclaim products may be necessary according that conditions explained before. Till today all costing of end-of-life or used products was internalized as cost of production that was, in last instance, determined by product design.

How the European Directive may change this practice by the obligation of the “take-back” process, and its products are exported while vehicles, adoption of different forms of demanufacturing and reverse logistics will have to be studied, like third-party firms or units, meaning that other issues will have to be answered and competences developed, like designs that facilitate the third-party take-back and the use of non-aggressive or restricted materials, with reasonable costs.
Acknowledgement

This paper was possible thanks to the support of CAPES - Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Agency (Brazil) and GKN do Brasil Ltda. – GKN Driveline.

References


