CASE: CAR MANUFACTURER

Challenges

End of Life (EOL) Vehicle Recovery is on the agenda. In the past the majority of used products were land-filled or incinerated with considerable damage to the environment. It is estimated that 10% of all hazardous waste generated in Europe originated from End of Life vehicles (ELVs). Recently landfill costs have increased steadily and are expected to continue to rise. Moreover many products can no longer be land-filled because of environmental regulations.

In the EU, new laws dictate that the producers of certain products such as vehicles must bear responsibility for their final disposal. These developments have given rise to a new material flow from the end user back to the producers; reverse logistics is concerned with the management of this material flow and its associated information flow.

Solution

PROMISE closes the loop by giving wider understanding of the cart life cycles.

The process:

1. Assebling the car
Car components, subsystems and systems are assembled onto the car body. At this phase, data regarding the production phase and a serial number are written on the PEID. The same data are written in the central database, along with detailed data regarding the production, the eventual supplier, the component composition and dismantling procedures and the car Bill of Material (BOM). The new car is then shipped to the client.

2. Using the car
The car is used by the user in different contexts. A component can differ considerably depending on the mission experienced by the component itself during its life. Tracing and analysing these different mission profiles help the dismantler in the selection of the correct removal decision for each specified component.

It is therefore necessary to define some effective “summary”, capable to synthesise mission profile. Once a suitable summary has been chosen, it is necessary to continuously update it during the usage of the car.
During the usage of the car, sensors acquire data and the ECU records these data which may support the clustering of the different missions into classes: for example the mean speed, the number of times the clutch is being used, the interval between clutch use may enable to partition the space of missions into city/ highway clusters. Other relevant data include RPM, driving wheel angle, pressure on brake pedal… In general these data regard information about the usage of the vehicle. These data are then recorded and stored in the next scene.

4. Memorising and storing data
The ECU retrieves data from the sensors already available in the car, e.g the tachymeter, using the actual wired connections existing in a car . The ECU aggregates the data into what is called summarising maps (indicating for example the number of times that the outside temperature was below 0 when the car engine was ignited).

The information are stored into a dedicated memory slot in the ECU, which is called the Onboard Diary (OBD). The “on-board diary” is able to assess the health of vehicle components in order to facilitate the process of identification of component worthing re-use. During the usage of the car, ECU elaborates and updates these maps of data.

In particular the PROMISE “on-board diary” collects information about the usage of the vehicle and it is capable to quantify the efficiency of the main vehicle subsystems / components at the moment of deregistration.

The information collected by the “On board diary” can be static and dynamic and refer to:
- product (composition, materials, cost, …)
- process (dismantling criteria, pre-treatment due to dangerous materials, …)
- use: general info (age, mileage of the vehicle)
- use: component specific working condition
- use: substitution of some component during the MOL and related reset of some ageing statistics

5. Determining the actions to be performed on the car
The dismantler decides the ELV’s recycling / recovery path and converts the ELV into components for reuse, remanufacturing or recycling. The dismantler’s role is critical for returning ELV components and information from EOL to BOL. He retrieves from external Databases the list of standard components to be removed from the car and checks if components in On Board diary are included in the standard list. At the same time he retrieves models (algorithms and costs) and thresholds from PDKM in order to compute wear-out level for each component and analyse economic value of parts.

In particular he decides which parts should be removed from the vehicle; how to recover (reuse or remanufacture) the removed parts; which customers should the parts be delivered to; and where to store the parts.

In the first stage, the system generates a bill of materials (BOM) of the car automatically based on the car model or identity number inputted in the background database; this BOM is used as the basis for developing a list of potentially valuable parts to remove, which also takes into account the requirements of legislation. Using the Dealer backend system, the list of components to be removed from the car is computed. An example is reported in the following figure:

Once this list of parts to be removed has been generated, the dismantler determines what on the projected list of car parts should actually be removed and what should not be removed owing to actual damage, abnormal wear-and-tear, or other factors that reduce the parts' value. The dismantler judges the destiny of each component by considering the legislation, quality, cost and market parameters.

6. Dismantling the car
After having decided the list of dismantling actions to be performed, the components are removed and the list of information is updated in PDKM. For each component the Decision Support System retrieves potential client, potential location and sends this information to PDKM. Besides, when the dismantler completes the job of dismantling the ELV components, any changes that have to be made to the printed list are transmitted back to the dismantler's backend system.

7. Storing the components
After having dismantled the car, the components which have been taken out of the car are dispatched to the warehouses, taking profit of the existing tags on-board of the components for automating the warehousing operations. For each component Tag Reader uploads this information from PDKM.

Values

Potential clients	OEM/ external	Business value	Metrics and Quantification
Design Department	OEM	Lifecycle automatic data acquisition and optimisation of component design Evaluation of driving habits	Improved quality and reliability, reduced costs
After Sales Department	OEM	Get grip on components degradation pattern Define and manage cost model Create portfolio or customised maintenance contracts and policies	Improved ROI CRM improvement
Authorised Garage	OEM/E	Minimum impact on effective dismantling process Automatic evaluation of parts status	Time reduction
Authorised Dismantler	E	Same as for Authorised Garage Automatic evaluation of parts status Optimisation of current processes: parts dismantling, diagnostics and evaluation	Time reduction
Remanufacturer	OEM/E	Automatic evaluation of parts status Selection of high potential parts based on value and cost models	Increased ROI
Fleet Manager	E/OEM	Monitoring of vehicle use (consumption, driving patterns…)	Total cost reduction: operation and maintenance
Insurance Companies	E/OEM	Propose OEM spare parts with official warranty May base refunds on vehicle history and driving habits	Reduced costs
Clients	E	OEM warranty on spare part	More value for money

Potential clients	OEM/ external	Business value	Metrics and Objective	Metrics and Objective
Authorised Garage	OEM	Optimisation of the operational dismantling process: automatic evaluation of parts status Minimum impact on operational process	Time reduction for the assessment of resell potential of components Added time with respect to normal operations	90 % Less than 5%
	OEM	Reselling spare parts	Total business value, expressed in percentage of the (fixed, standard) cost occurred for a car dismantling.	40%