

NETWORKED RFID SYSTEMS IN PRODUCT RECOVERY MANAGEMENT

RESEARCH PROBLEM

Product recovery management is complicated due to the uncertainty in product returns in terms of quantity, quality, type, and timing. This uncertainty arises due to the lack of information associated with returned products. Many companies find that the acquisition of information required to make various decisions during product recovery is problematic. The required data is not available due to the progressive loss of product information throughout its lifecycle as shown in figure 1.

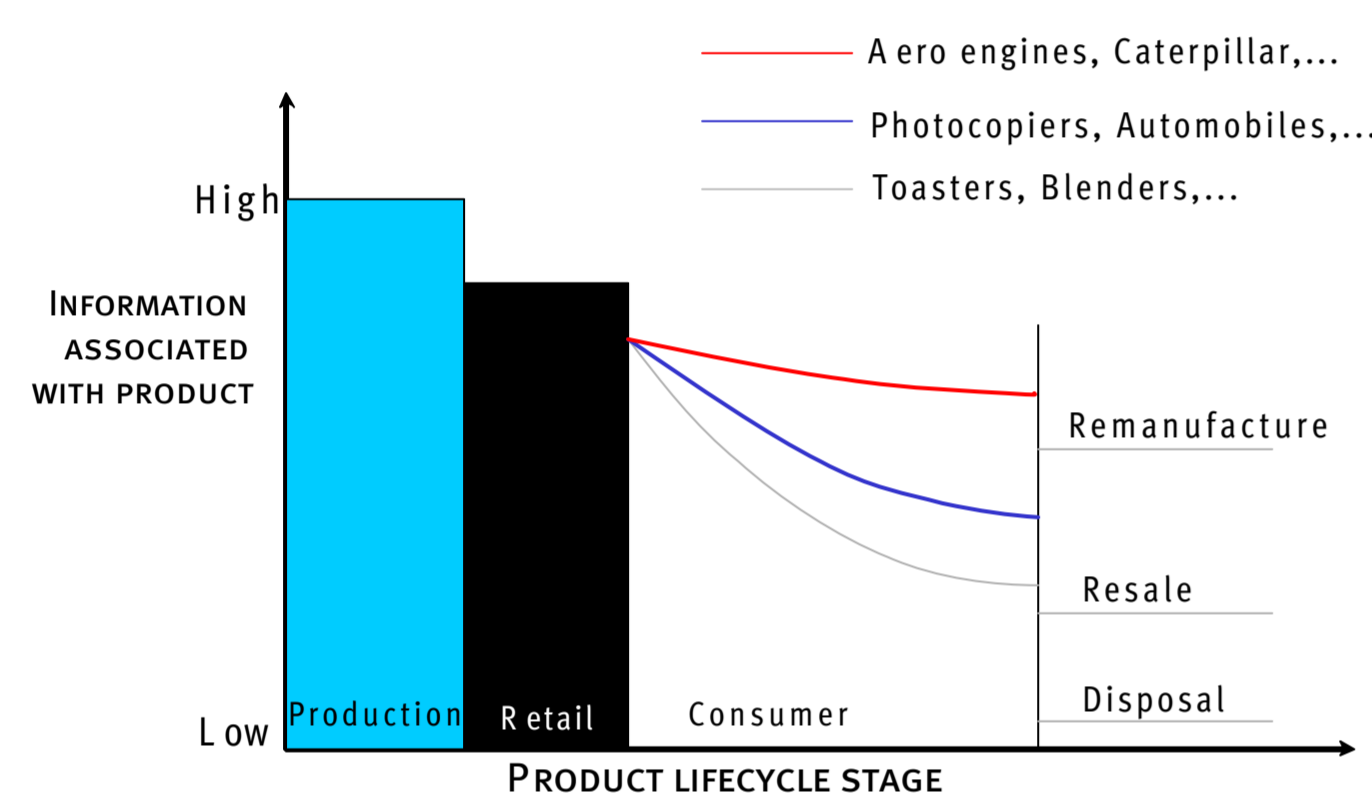


Figure 1

Frequently, the required data is scattered through out the company and across the companies in the supply chain network. Retrieving information from such network requires work of significant efforts and intervention of a number of people with various levels of competence.

One solution for the management of information associated with products is the product-oriented approach. A product-oriented approach is the one by which information is maintained at the unique item level and is updated as the product moves along the various stages of its lifecycle. This will enable decision support that handles the unique requirements of every single product.

A recent breakthrough in enabling affordable widespread global deployment of Radio Frequency Identification (RFID) is the emergence of the so called "EPC Network"- essentially a networked RFID strategy- as a means of providing such a product-oriented approach.

RESEARCH AIM

We are examining the role of ready availability of product information – as derived, for example, from the EPC Network – in product recovery management. The EPC Network can play a crucial role in reducing the time delays in recovering value from the returned products by uniquely identifying a product throughout its lifecycle, monitoring and updating the state of product as it moves along its lifecycle and providing the relevant information in a timely fashion at the end-of-life stage for better management of such products.

The aim of this research is to provide quantitative assessment of the value of information and co-ordination, enabled through the EPC Network, in product recovery management. The research aims to develop a general research methodology to quantify the benefits of information, and investigate economic and practical feasibility of the EPC Network in product recovery management. In this context, we are investigating the role of the EPC Network in:

1. Product Recovery Decisions
2. Remanufacturing Inventory Management

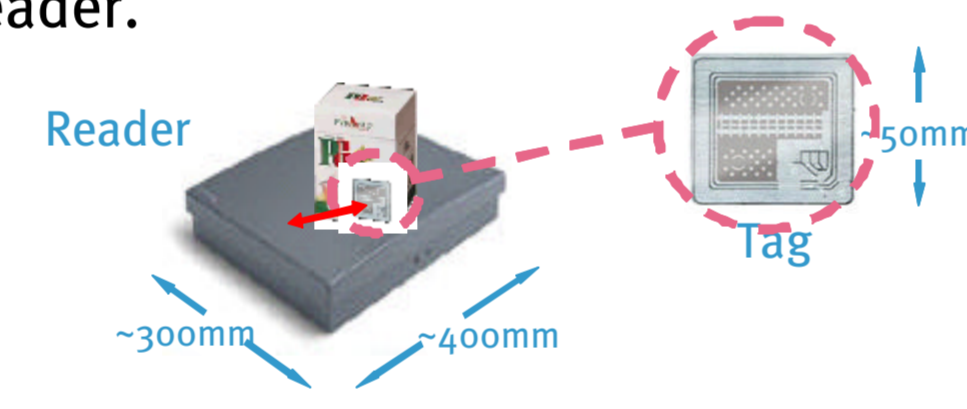
WHO WE ARE

The Auto-ID Labs is a federation of research universities that has evolved from the Auto-ID Center, initially founded in 1999 to develop an open standard architecture for creating a seamless global network of physical objects. Funded in part by the EAN.UCC, governments, and industry, Auto-ID Labs is based at the Center's same six leading universities worldwide -MIT, University of Cambridge, University of Adelaide, Keio University, Fudan University, and University of St. Gallen. Each with distinct interests and capabilities, but linked by the common vision of an "Internet of things," we continue to research and develop new technologies and applications for revolutionising global commerce and providing previously un-realizable consumer benefits. The Cambridge Auto-ID Labs is based at the Cambridge University Engineering Department. The labs focuses on core research in the EPC Network and providing technical and educational services.

EPC NETWORK BUILDING BLOCKS

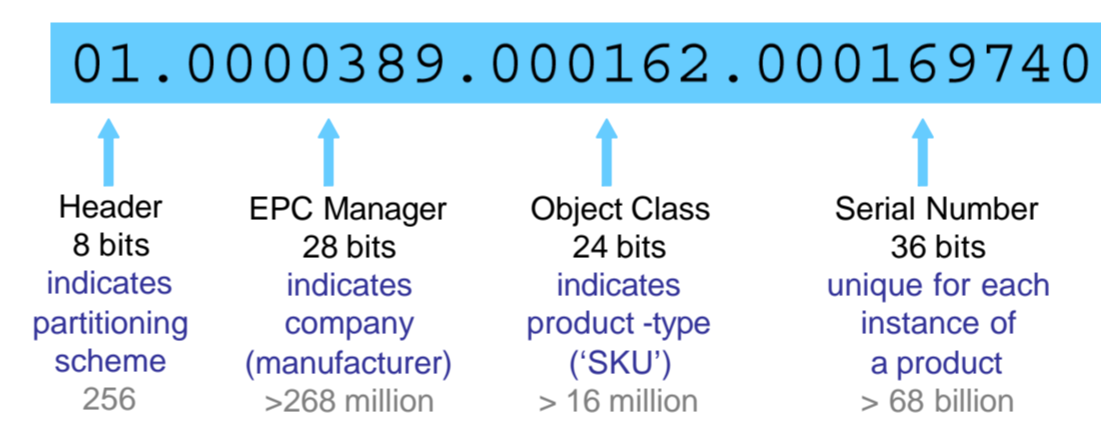
1. Tags and Readers

Radio Frequency Identification (RFID) is a key technology enabling automatic reading multiple objects simultaneously, without requiring scanning of each individual object. RFID tag stores the EPC code of each object which is read by a reader.



2. The Electronic Product Code (EPC)

The aim of the EPC is to provide a unique identifier for each object. The EPC is a number which is stored in tags and the associated information is stored in the networked database (EPCIS)



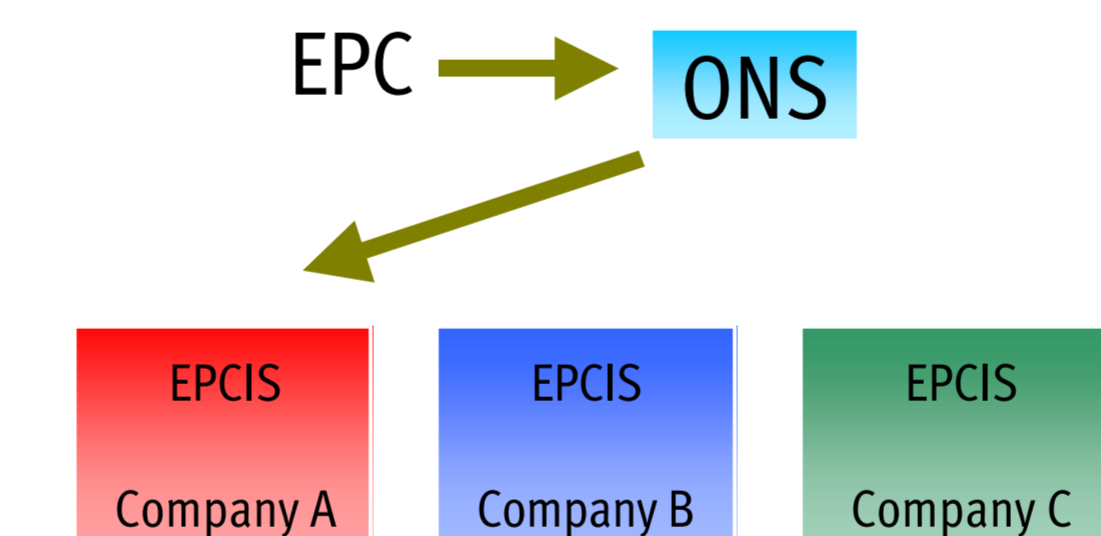
3. The EPC Information Service (EPCIS)

It is a networked database which stores comprehensive data about manufacturer's products.

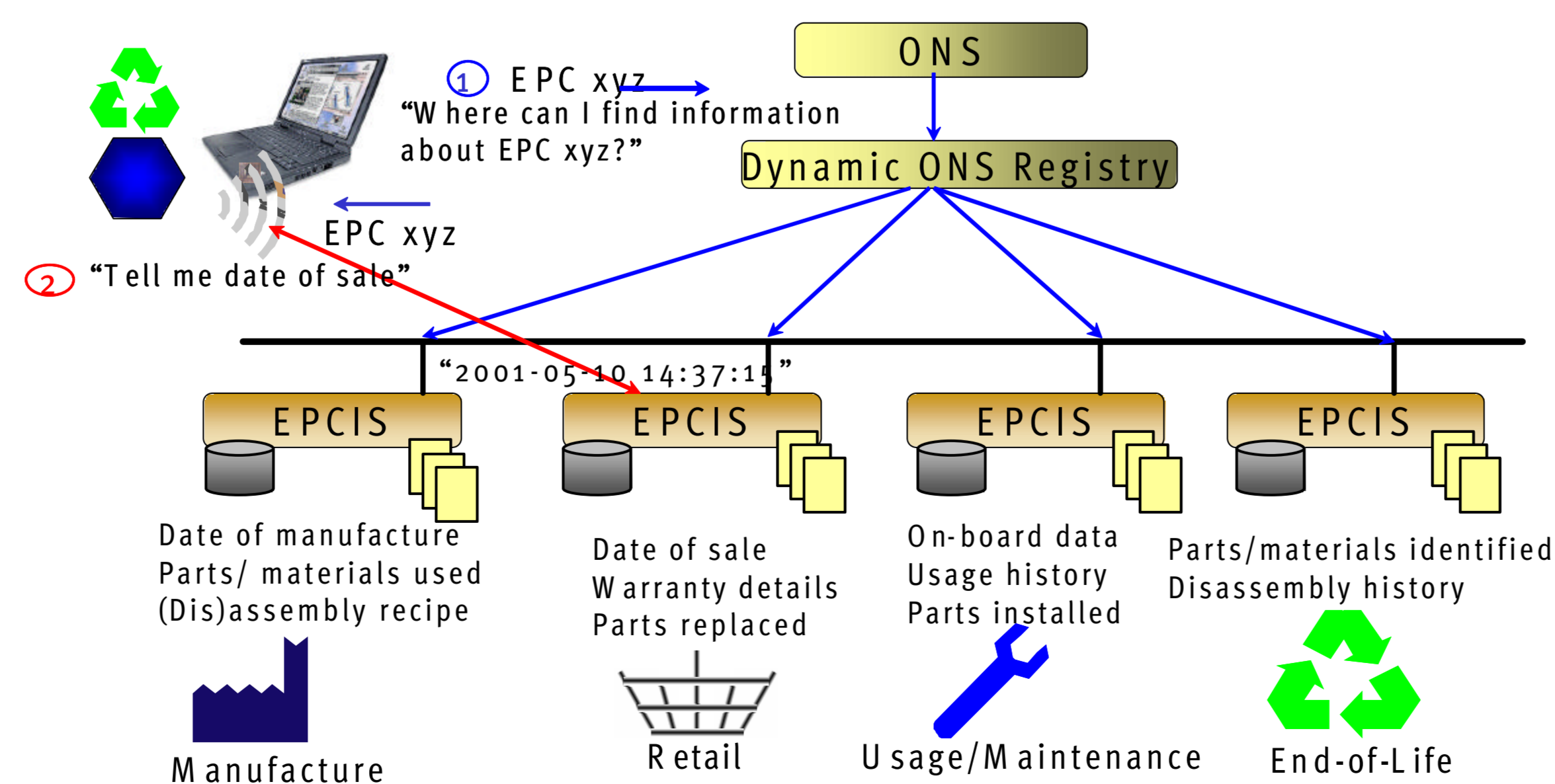
Storage of 'EPC-related' data	
Time stamped event data	Attribute data (often static)
Observations (Tag readings)	Attributes defined at serial level
Measurements (Sensor data)	Example: date of manufacture
Symbolic location	Attributes defined at product level
EPC - Transaction ID	Examples: mass, dimensions

4. The Object Name Service (ONS)

The ONS is used to convert an EPC of a product into the address of a server which has extensive information about the product.



How EPC NETWORK WORKS



EPC NETWORK IN PRODUCT RECOVERY DECISIONS

When a product is returned by its user, there are several ways by which value can be recovered from it – the product can be reused as is, reused after remanufacturing, recycled to recover its material contents, or incinerated for energy recovery. The choice of appropriate product recovery decision greatly depends upon the availability of relevant product information during the decision-making process. In the case of products that are apparently valuable, this information is collected by performing extensive inspection and testing (see figure 2). This information gathering process is labour intensive and time consuming which causes delays in recovering the value from returned products.

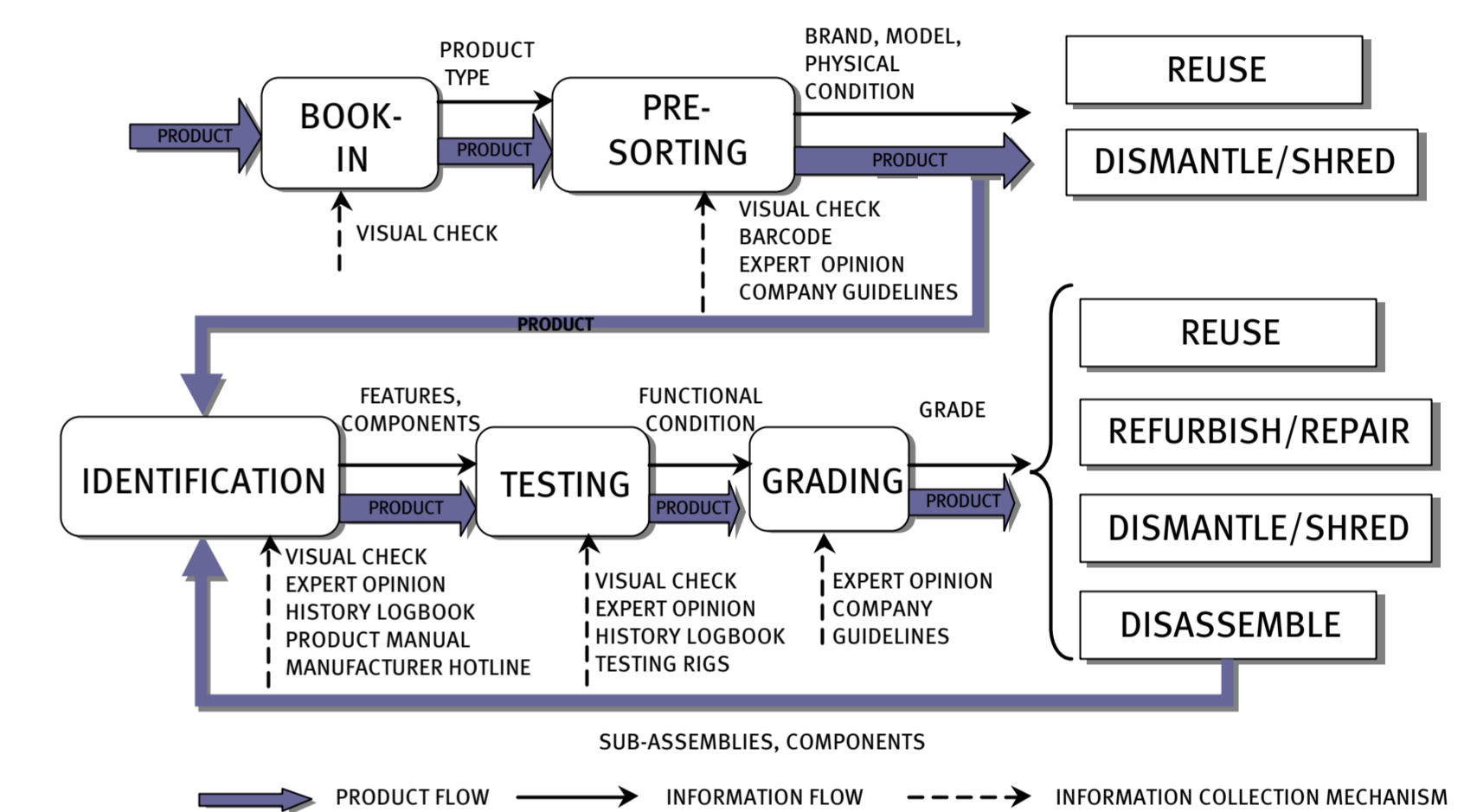


Figure 2

The EPC Network can bring two-fold benefits by providing product information in a timely manner: (a) decision improvements – being able to make informed decisions in a timely manner, and (b) process improvements – being able to facilitate automation of disassembly processes, thus improving the cost-effectiveness and efficiency of product recovery operations. Furthermore, improved product recovery operations will result in increased amounts of reuse of products and components in future.

EPC NETWORK IN REMANUFACTURING INVENTORY MANAGEMENT

Product remanufacturing involves disassembling a returned product to its constituent parts, differentiating between serviceable parts and scrap, and using a combination of serviceable parts and new parts to rebuild the product. An essential operational issue of remanufacturing is inventory management which involves planning of disassemblies (when, what and how much to disassemble). These inventory planning decisions are complicated due to the lack of timely information associated with returned products.

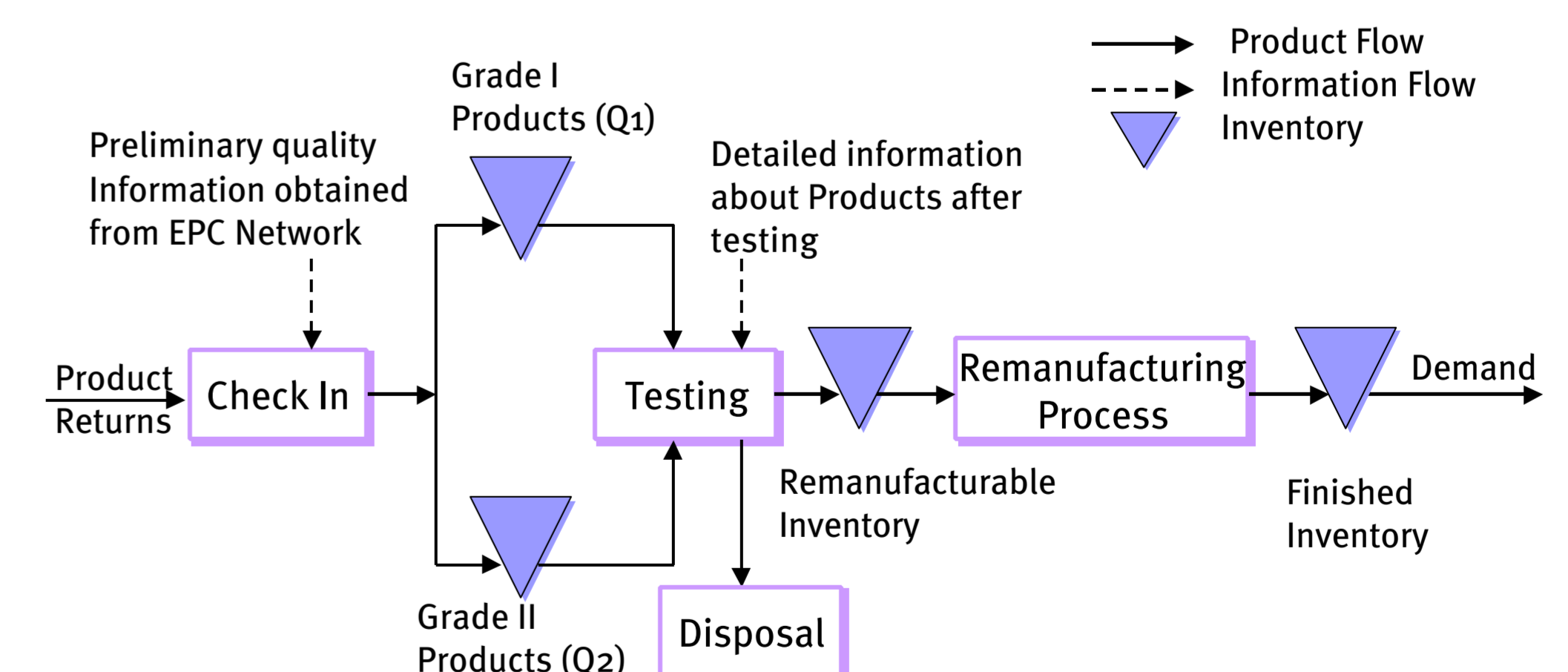


Figure 3

There appears to be a significant potential for the EPC Network to reduce inherent uncertainties in remanufacturing by providing relevant information in a timely fashion. As shown in figure 3, products can be immediately pre-sorted into different categories based on their preliminary quality information obtained from the EPC Network after check-in. Good quality products are prioritised for testing and remanufacturing. This will reduce time delays in processing the returned products with high economic value leading to higher inventory turns. Moreover, there will be less uncertainty about intrinsic condition of returned products available on the shop floor. Therefore, manager can take better decisions about when to start testing and remanufacturing of returned products without stocking high inventory.