

APICS INSIGHTS AND INNOVATIONS

EXAMINING REMANUFACTURING IN SUPPLY CHAIN AND OPERATIONS MANAGEMENT

APICS
SUPPLY CHAIN
COUNCIL

ABOUT THIS REPORT

Research shows that remanufacturing is growing in maturity in many industries and organizations, and skilled professionals are essential to that development. APICS conducted a survey of supply chain and operations management practitioners in response to a growing interest in remanufacturing and requests for more in-depth research. In 2013, APICS invited approximately 18,000 practitioners to participate in the survey.

APICS Research Reports are based on practitioner surveys that explore trending topics in supply chain and operations management. They include survey results, analysis, tips, and best practices to keep you and your organization informed of insights and innovations in supply chain and operations management.

This report was developed by APICS SCC, the foundation arm of APICS. APICS SCC advances supply chain and operations management and innovation through research, publications, education and talent development. Organizations and academic programs gain access to the information they need to contribute to the success of supply chains and meet enterprise goals through the foundation's exceptional network and resources.



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APICS Research **23**

Additional Resources

These organizations and publications provide resources and detailed information about the topic.

The Remanufacturing Institute
www.reman.org

Centre for Remanufacturing
and Reuse UK
www.remanufacturing.org.uk

National Key Laboratory
for Remanufacturing China
www.chinaremanufacture.net/kfjj/kfjj.htm

Remanufacturing Industries Council
remancouncil.org/

Journal of Remanufacturing
www.journalofremanufacturing.com

ReMaTecNews.com
www.rematecnews.com

Center for Remanufacturing -
Rochester Institute of Technology
www.rit.edu/gis/remanufacturing/

United States International Trade
Commission: Remanufactured
Goods: An Overview of the U.S.
and Global Industries, Markets,
and Trade - October 2012
[www.usitc.gov/publications/332/
pub4356.pdf](http://www.usitc.gov/publications/332/pub4356.pdf)

A full version of this report is available free to APICS members. Log in to the APICS website to access additional analysis and insights on this topic. If you aren't a member, join APICS today. Nonmembers may also purchase the full report.

EXAMINING REMANUFACTURING IN SUPPLY CHAIN AND OPERATIONS MANAGEMENT

Remanufacturing:

The *APICS Dictionary*, 14th edition, defines remanufacturing as an industrial process in which worn-out products are restored to like-new condition. In contrast, a repaired product normally retains its identity, and only those parts that have failed or are badly worn are replaced or serviced.

EXECUTIVE SUMMARY

Remanufactured goods are an opportunity in price-sensitive markets and the growing field of emerging economies. Technology is making designed-for-remanufacturing product development easier and more cost effective than in the past. Many expect these trends to continue in the long-term. Organizations are increasingly seeking greater value from supply chains. Investments already made for reverse supply chain capability, such as recycling or regulatory compliance, mean remanufacturing has even more opportunity to leverage existing supply chain partnerships and infrastructures.

Global Acceptance

In the past, remanufacturing was typically limited to supporting business-to-consumer (B2C) warranty, customer returns, and business to business (B2B) return of capital-intensive “core” products (such as engines and industrial goods) to long-term service, within a domestic or regional marketplace. While these applications remain, new reasons for entering the remanufacturing market are growing. Remanufacturing and reverse supply chains are essential for:

- New market development
- Customer service
- Value-chain development
- Sustainability
- Research and development.

Career Development for Supply Chain Professionals

Becoming experienced and skilled in remanufacturing helps make the careers of supply chain and operations management professionals more versatile.

Remanufacturing requires new skills in forecasting, planning, inventory management, and many other supply chain practices. With these skills, a professional can better identify potential for opportunity and innovation in traditional forward supply chains and reverse supply chains.

KEY FINDINGS

Remanufacturing adds complexity to supply chains. A reverse supply chain, where the customer becomes the supplier, presents complexities not found in traditional supply chains. Approximately 59 percent of survey respondents stated that reverse supply chains add complexity to their organizations. However, practitioners expect growing demand for remanufactured goods, so understanding and training for remanufacturing is becoming a necessity.

Improving Visibility and Integration

Organizations may not be gaining all the value they can from their remanufacturing operations because of low visibility compared to the rest of the organization.

>35%

More than 35 percent of respondents stated that remanufacturing is a key method of complying with sustainability policies, goals, and requirements.

14%

Only 14 percent of survey respondents stated that remanufacturing was part of their R&D process.

≈48%

Approximately 48 percent of respondents stated that remanufacturing was somewhere between less than **moderately visible** and **not visible at all**.

Remanufacturing directly serves the growth of the reverse supply chain, sustainability and value-chain, and research and development. In addition, it serves more traditional functions including warranty, maintenance repair, and overhaul (MRO), and customer request. Combined, remanufacturing increasingly supports high-priority goals, competitive practices, and critical customer service functions.

Challenges in Forecasting and Opportunities with IT

It's difficult to forecast the condition of many used products returning to the remanufacturing process. More than 32 percent of respondents reported that their information technology (IT) systems were poor at forecasting anticipated demand. This is not surprising. Relying on the customer as your supplier often means enduring greater variability in supply quantity and quality. This makes forecasting more difficult compared to forecasting supply from traditional new suppliers. Remanufacturing operations must address continually varying component conditions. Others reported issues with enterprise resources planning (ERP) systems support.

Technology is creating many options in designed-for remanufacturing, and many other designed-for attributes, such as designed-for six sigma or designed-for assembly. Product design in component materials, assembly options, and product tracking are improving. Past challenges related to inefficient core parts, or difficult to remanufacture parts, are addressed in the design phase and create new value chain opportunity.

IT Solution Assessments

Respondents were asked to rate remanufacturing-related IT solutions used by their organizations.

	Poor	Fair	Good	Excellent	Don't know
Anticipated demand forecasting	32%	27%	28%	7%	6%
Incoming or outgoing product core credits and charges	15%	26%	34%	16%	9%
Multiple product or component versions	17%	27%	35%	13%	8%
Inventory	14%	26%	35%	20%	5%
Data integration with other departments and systems	22%	26%	37%	9%	6%

Advancing Remanufacturing Skills

Remanufacturing skills are generally transferable to traditional “forward” supply chain and operations management practices.

- Staff and professionals can cross-train and transfer between forward supply chain and or remanufacturing.
- Survey results show that specific remanufacturing skills such as sales and operations planning (S&OP), inventory management, scheduling, and planning are highly transferable to new product manufacturing.
- More than 50 percent of survey respondents agreed that most supply chain and operations management professionals need familiarity with the topic of remanufacturing.
- The improvement of legal and trade recognition of remanufactured goods, designed-for-remanufacturing technologies, trends of sustainability, and value-chain will help remanufacturing uncover new opportunities for supply chain professionals.
- Practitioners expect growing demand for remanufactured goods.
- Meeting increasing demand for remanufactured goods requires strategic-level consideration of both new and remanufactured product production.

Skill Set Transferability

Respondents were asked to assess the transferability of the following remanufacturing skills to new product manufacturing.

	1 Not at all	2	3	4	5 Moderate	6	7	8	9	10 Very
Planning	3%	5%	2%	5%	16%	4%	14%	17%	12%	22%
Procurement	2%	2%	4%	5%	14%	5%	13%	17%	14%	24%
Scheduling	2%	4%	7%	3%	10%	8%	13%	22%	11%	20%
Production	2%	2%	5%	6%	14%	11%	11%	19%	11%	19%
Customer service	2%	4%	4%	2%	10%	7%	11%	18%	14%	28%
S&OP	5%	8%	3%	4%	12%	6%	11%	16%	16%	19%
Inventory	2%	6%	4%	6%	13%	6%	8%	17%	14%	24%

Questions for Discussion

Use these questions to help assess the role played by remanufacturing in your organization:

How would you answer the survey questions for your organization?

Comparing your results with those of our respondents may be useful in assessing the strengths and weaknesses of your organization's current remanufacturing operation.

Is your organization considering the addition of a remanufacturing operation?

Consider using these survey responses as guidelines to maximize benefits and reduce shortcomings while planning.

Remanufacturing vs Refurbishing

Only 32 percent of respondents stated that most or all of their management could distinguish between remanufacturing (meaning restore to as good-as-new condition) and refurbishing (meaning restore to a serviceable condition).

RESPONDENT PROFILE

The majority of respondents surveyed had professional experience in remanufacturing and about a fifth had worked a decade or more in the area.

≈35% Approximately 35 percent of respondents indicated that their organizations' production facilities currently use remanufactured equipment.

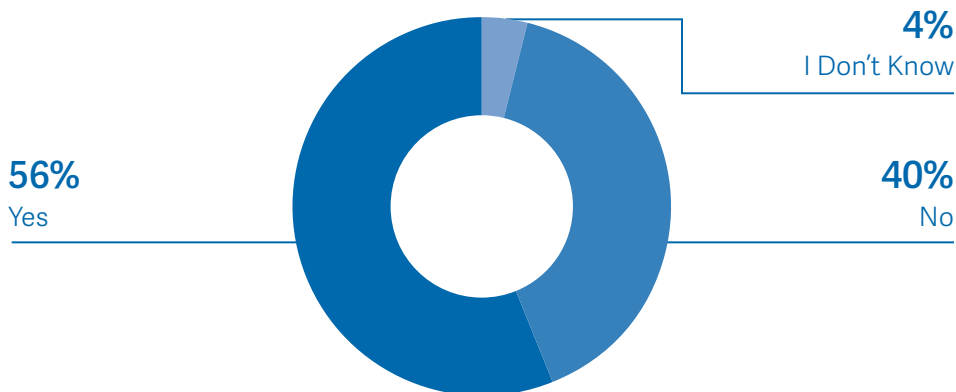
>25% More than 25 percent of respondents indicated that most or all of their competitors offer remanufactured products similar to those produced by their organizations.

>50% More than half of the respondents surveyed have spent more than 12 years in supply chain or operations management positions.

≈33% Approximately a third of the respondents were from the manufacturing industry, followed by the healthcare and pharmaceutical, telecommunications, food and beverage, and automotive industries.

Remanufacturing Experience

Respondents were asked whether or not they have professional remanufacturing experience in supply chain or operations management.



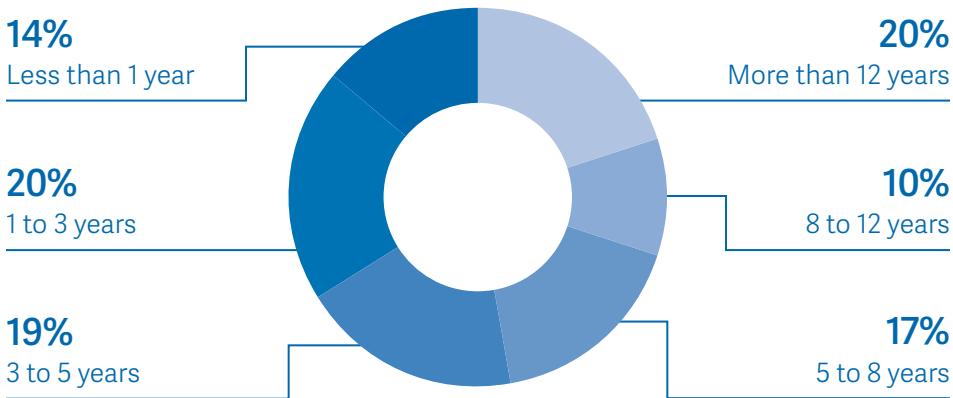
Necessity of Remanufacturing Knowledge

Respondents were asked to indicate their level of agreement with the following statement: **“Most supply chain and operations management professionals need at least some familiarity with the topic of remanufacturing.”**

1 Strongly Disagree	2	3	4	5 Neither Agree nor Disagree	6	7	8	9	10 Strongly Agree
1%	2%	2%	1%	8%	10%	20%	21%	12%	23%

Extent of Remanufacturing Experience

Respondents were asked to indicate the amount of experience they have with producing remanufactured products.



Customer-to-Supplier Transition

Respondents were asked to identify the reason(s) a customer might eventually become a supplier to their remanufacturing operations.

54%

Remanufacturing is our process for taking in customer returns, and providing warranty replacement products to the customer.

39%

Customers demand or expect the option of remanufactured products. Remanufacturing is a competitive requirement to serve our market.

35%

Remanufacturing is a key method of complying with sustainability policies, goals, and requirements.

23%

A high-cost product eventually requires more maintenance or repair than a customer's own maintenance-repair-overhaul (MRO) process can handle. These customers prefer to sell back their old product and purchase an identical remanufactured product.

22%

Specific price-sensitive markets see value in remanufactured items; while these markets cannot be easily reached by your customer, they can be reached by your organization.

13%

Remanufacturing is part of my organization's research and development (R&D) process. We remanufacture products in order to gather information on actual customer usage and wear patterns.

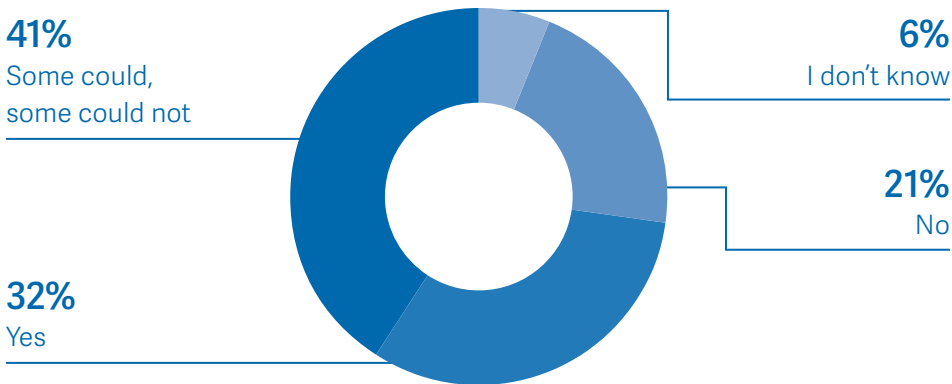
Visibility

Respondents were asked to assess the level of remanufacturing visibility in their organizations.

1 Very Visible	2	3	4	5 Moderately Visible	6	7	8	9	10 Not at All Visible
1%	2%	2%	1%	8%	10%	20%	21%	12%	23%

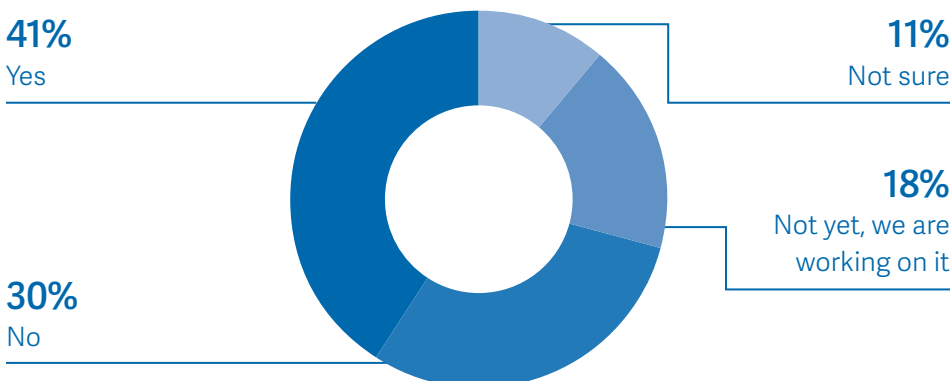
Remanufacturing Versus Refurbishing

Respondents were asked if their organizations' management is generally able to distinguish between the terms "remanufacturing" (restoring to 'as good as new condition') and "refurbishing" (restoring to 'a serviceable condition').



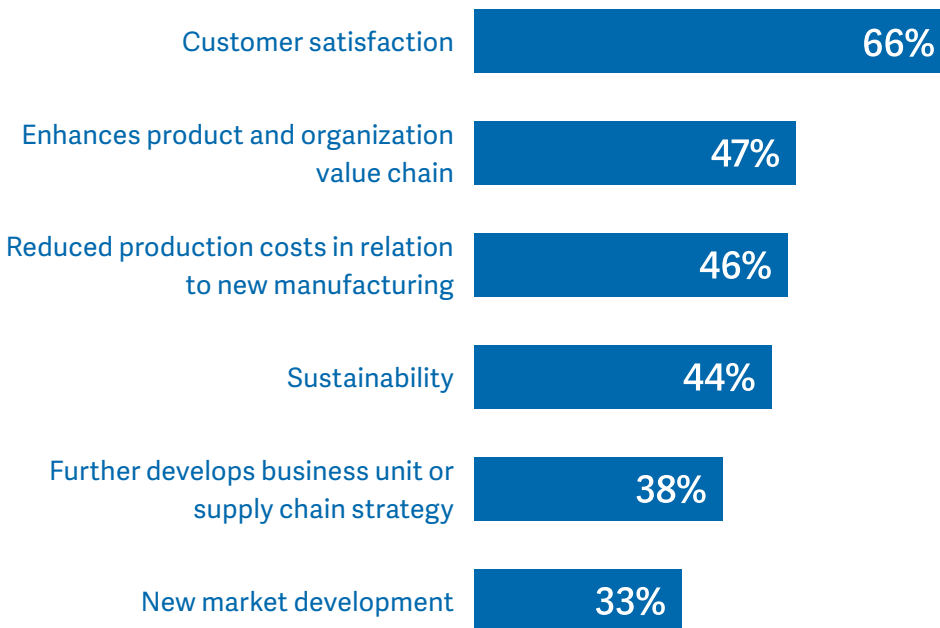
Sustainability Policy Inclusion

Respondents were asked whether or not remanufacturing is considered to be a formal component of their organizations' sustainability policies.



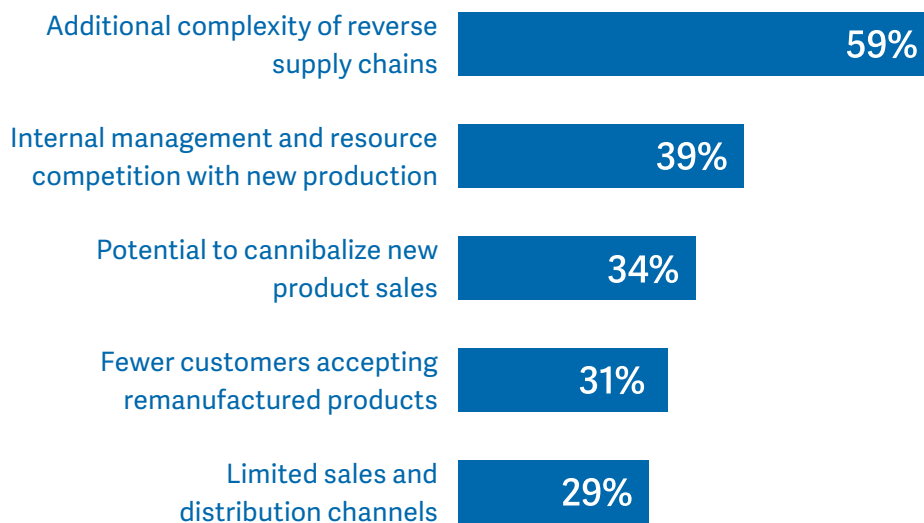
Organizational Benefits

Respondents were asked to select the way(s) in which remanufacturing benefits their organizations.



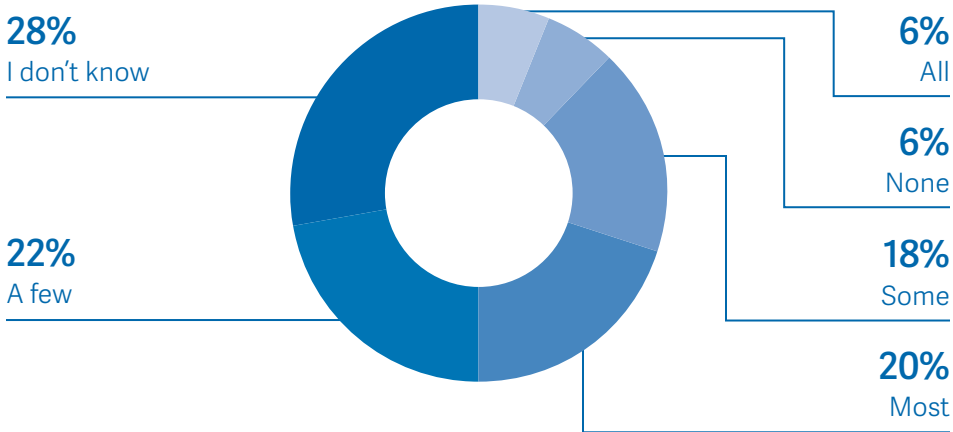
Organizational Challenges

Respondents were asked to select the challenge(s) posed by remanufacturing to their organizations.



Competition

Respondents were asked to indicate how many of their competitors offer remanufactured products similar to those produced by their organizations.



Long-term Forecasting

Respondents were asked which statement best reflects long-term forecasts of customer demand for remanufactured products in their respective markets.

28% Demand will grow at moderate rates as existing customers continue to see value in remanufactured products.

24% Demand forecasts are too difficult to develop at this time.

20% Demand will grow at substantial rates as increasing numbers of new customers will find greater value, lower cost, or additional flexibility in remanufactured goods.

15% Demand for remanufactured goods will fall as customers seek to buy new products and new designs due to high rates of technological change.

Customer or Market-based Perceptions

Respondents were asked to select the customer or market-based perception(s) of remanufacturing they have encountered.

71% Even if the quality is the same, remanufactured goods have lower resale value than newly manufactured goods.

37% Remanufacturing is a fancy term used to resell used products.

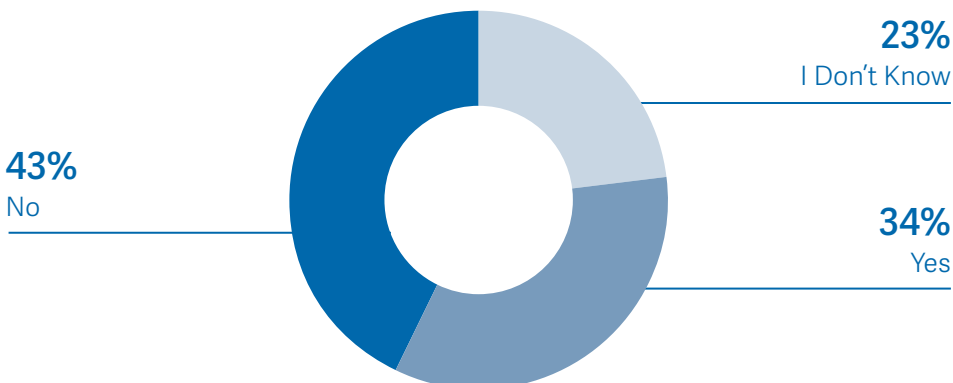
24% No manufacturer really wants remanufactured products to succeed because they hurt new product sales.

22% Remanufactured products have poor warranty or after-sales service.

19% Since remanufactured goods are lacking in national and global standards, product quality and performance are too variable to trust.

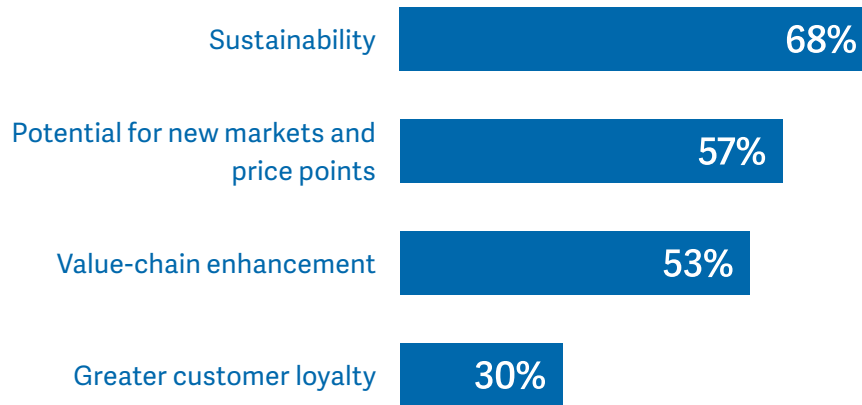
Remanufactured Equipment in Production Facilities

Respondents were asked whether or not their organizations currently use remanufactured equipment in their production facilities.



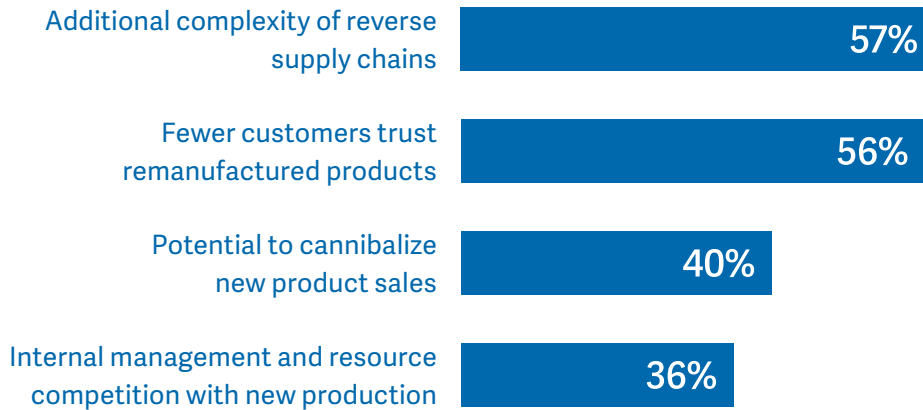
Advantages

Respondents were asked to select the advantage(s) they associate with remanufacturing, based on their experiences.



Drawbacks

Respondents were asked to select the drawback(s) they associate with remanufacturing, based on their experiences.





GLOSSARY AND ADDITIONAL RESOURCES

GLOSSARY

Closed-loop manufacturing

Closed-loop manufacturing is a system in which a product is created using renewable energy, with no pollutant output and no waste—the materials used in production are recycled and reused, not discarded. Products are built for durability and reuse, and producers are responsible for the entire product lifecycle, including the post-consumer phase. The concept is rooted in circular concepts of product design and production.

Corporate social responsibility

Corporate social responsibility means using fair and beneficial business practices regarding labor and the community or region where a firm conducts its business. It is about providing a safe work environment, giving back to a community by contributing to health care and education, and avoiding the exploitation of labor and resources of an area.

Demanufacturing

Demanufacturing, or disassembly, is often used for products that will be recycled or remanufactured. However, remanufacturing may use processes that seek to preserve design and intellectual property rather than recycled scrap value. For example, scrap vehicles may undergo demanufacturing to ensure that recyclable materials such as metals or plastics are not mixed, rather than restoring the vehicle or a component to as good-as-new condition.

Inventory pooling

The act of holding inventory in a single location instead of multiple locations.

Product life cycle management (PLM)

The process of facilitating the development, use, and support of products that customers want and need. PLM helps professionals envision the creation and preservation of product information, both to the customer and along the reverse-logistics portion of the supply chain.

Recycle

- 1) The reintroduction of partially processed product or carrier solvents from one operation or task into a previous operation.
- 2) A recirculation process.

Rebuilding

The term rebuilding was used prior to the term remanufacturing. "Rebuilt," may in some circumstances, refer to a product that underwent a process similar to remanufacturing but not necessarily to achieve good-as-new condition. Rebuilding may also refer to work performed on a single unit, such as a "bench rebuilt" unit, and many not define a manufacturing-style process production and operations management.

Remanufacturing

- 1) An industrial process in which worn-out products are restored to like-new condition. In contrast, a repaired product normally retains its identity, and only those parts that have failed or are badly worn are replaced or serviced.
- 2) The manufacturing environment where worn-out products are restored to like new condition.

Reuse

To use again in a new or different way than originally intended for a product, or to use again after a product undergoes reclaiming or reprocessing work. Remanufactured products normally return to their originally intended purpose.

Reverse logistics

A complete supply chain dedicated to the reverse flow of products and materials for the purpose of returns, repair, remanufacture, and/or recycling.

Reverse supply chain

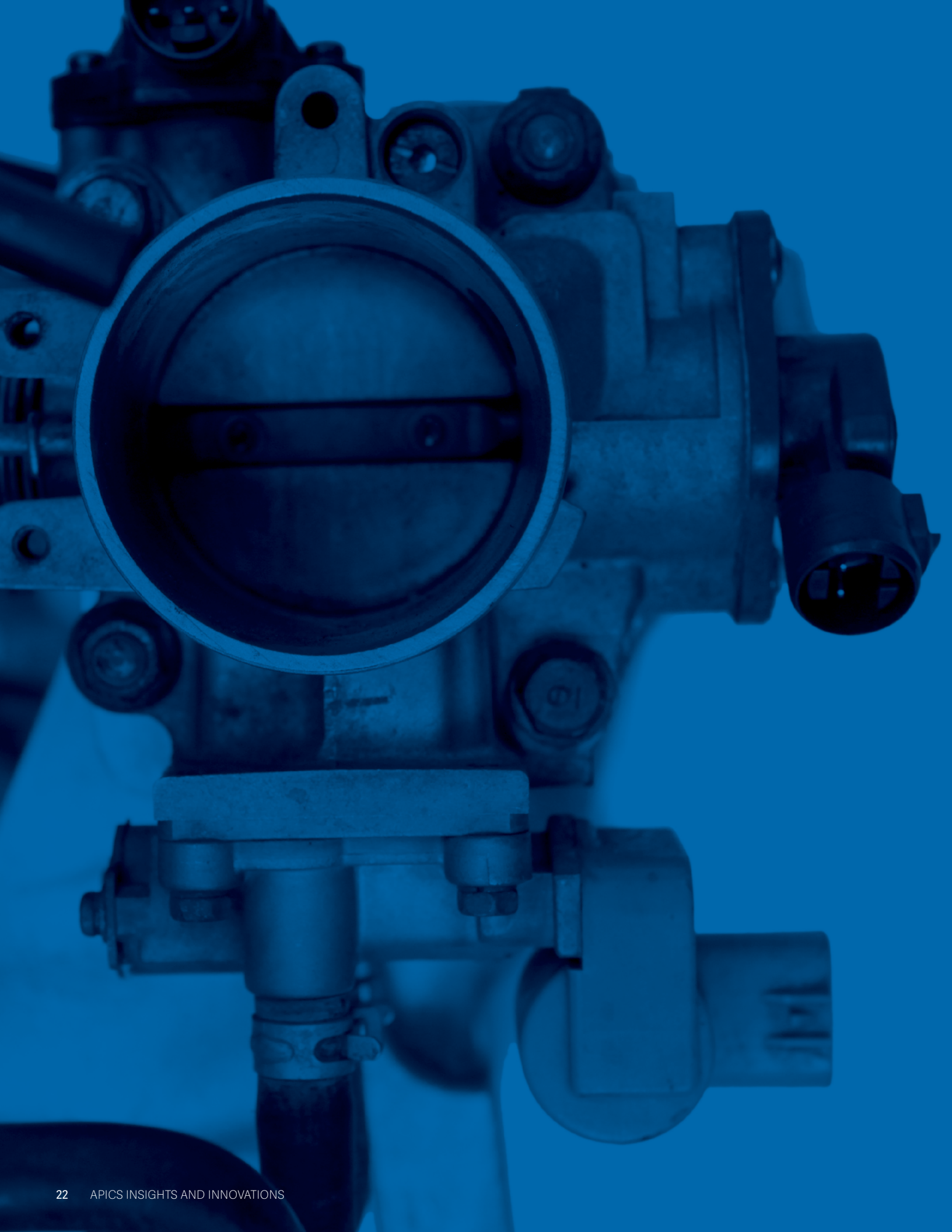
The planning and controlling of the processes of moving goods from the point of consumption back to the point of origin for repair, reclamation, recycling, or disposal. **See: reverse logistics.**

Value chain

The functions within a company that add value to the goods or services that the organization sells to customers and for which it receives payment.

Value stream mapping

A lean production tool to visually understand the flow of materials from supplier to customer that includes the current process and flow as well as the value-added and non-value-added time of all the process steps. Used to lead to reduction of waste, decrease flow time, and make the process flow more efficient and effective.



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