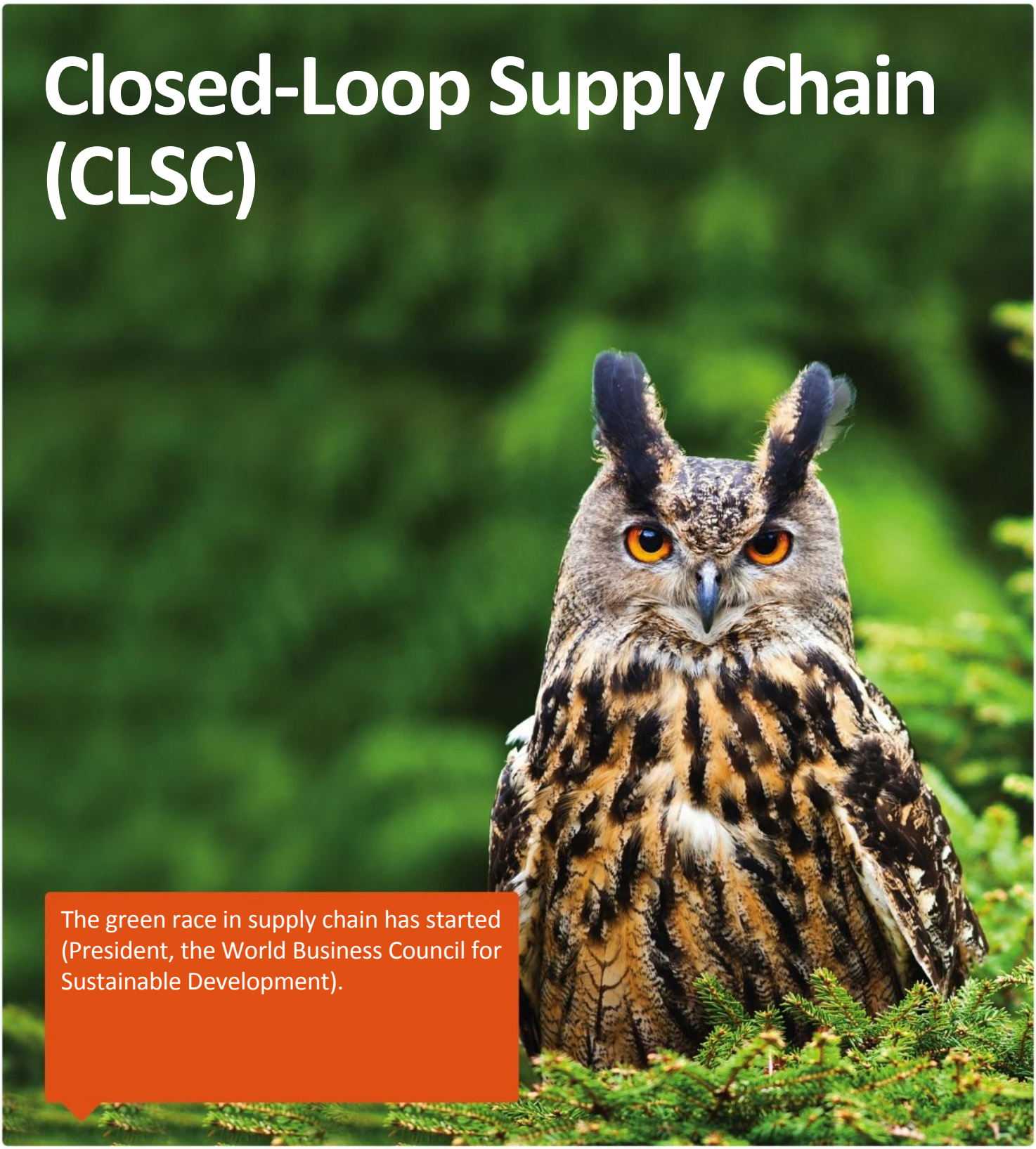
Closed-Loop Supply Chain (CLSC)



The green race in supply chain has started (President, the World Business Council for Sustainable Development).

CIPS members can record one CPD hour for reading a CIPS Knowledge download that displays a CIPS CPD icon.

Introduction

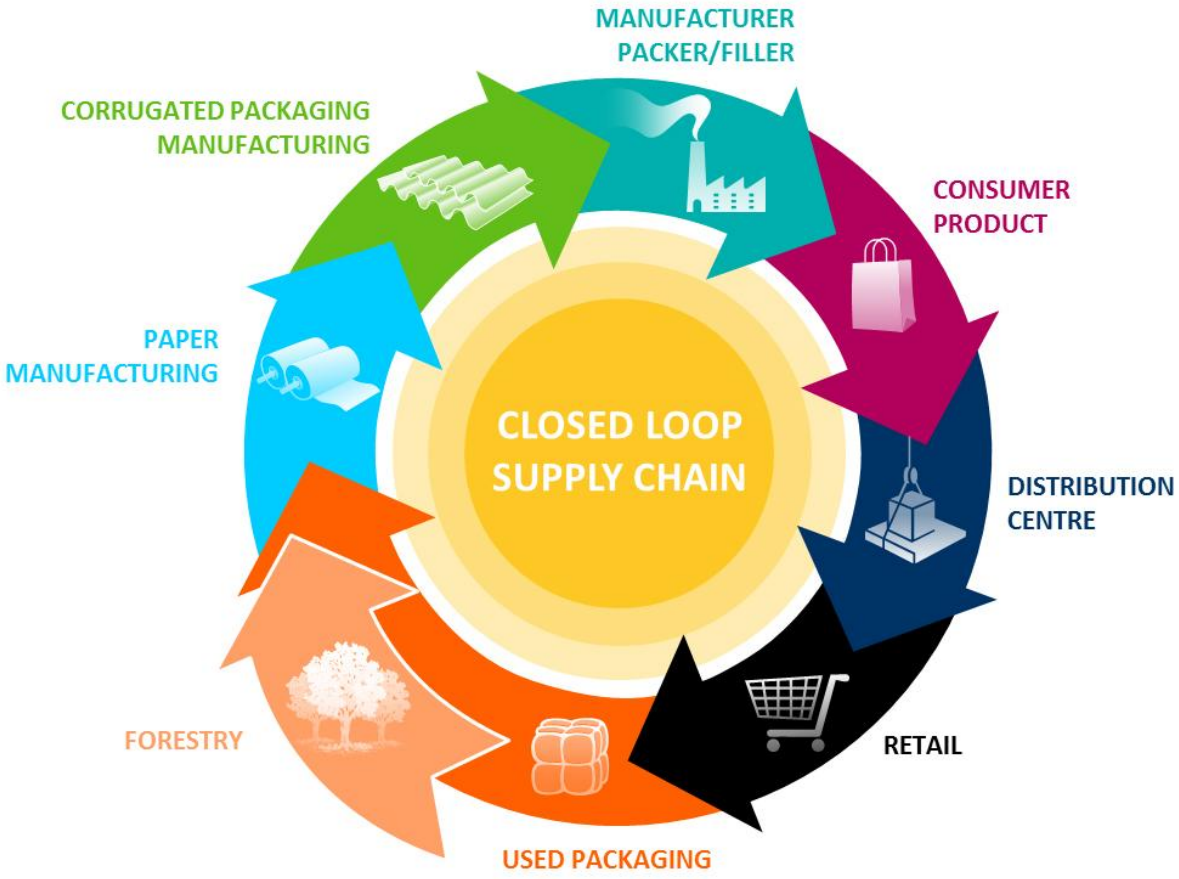
CLSC mainly occur due to commercial returns, warranty replacements, recycling and reuse or leased equipment renewals (Easwaran and Uster, 2009). CLSC generally incorporates activities observed in both the traditional forward supply chain and in the reverse supply chain (Guide et al., 2003). Generally, CLSCs follow a channel similar to the forward channel but in the reverse direction (Easwaran and Uster, 2009). In the forward supply chain raw materials are manufactured into new products, where in the reverse supply chain it is used products that are remanufactured.

Unlike traditional supply chains, the reverse supply chain activities incorporated in the CLSC can include product acquisition from end-users, reverse logistics (moving the products from the points of use to a point of disposition), testing/sorting/disposition to determine the product's condition and the most economical reuse option, refurbishing to enable direct reuse/repair/remanufacture/recycle/disposal and remarketing to create and exploit markets for refurbished goods, and distribution of same (Akcali et al., 2009; Guide et al., 2003). Remanufacturing is an important component of the CLSCs (Guide et al., 2003; Easwaran and Uster,2010).

The concept (CLCS) has recently gained popularity due to the tightening of environmental regulations, increasing product returns and the identification of new business opportunities related to the residual value of end-of life products (Matthews, 2004). Strict government regulations addressing product end-of-life issues such as recycling rates, level of recycled content, and take-back percentages have forced manufacturers to rethink their product recycling options. In the UK, the EU Waste Electrical and Electronic Equipment (WEEE) Directive that came into force in 2007 requires British producers and importers of electronic goods to recycle their products. Similar legislation has also been introduced in Canada, Japan, China and a number of states in the US (Environment Agency, Neto et al., 2009). Another relevant regulation is a number of Automotive directives that require force manufacturers and importers of cars and electronics to offer take-back solutions for end-of-life products.

Definition

Closed-loop supply chains (CLSC) are supply chain networks that "include the returns processes and the manufacturer has the intent of capturing additional value and further integrating all supply chain activities" (Guide et al., 2003).



Successful Application

There are a number of important characteristics for the successful implementation and running of CLSCs. For example, it is important to ensure a smooth flow of activities and goods through the supply chain. Some of the factors that can complicate the management and planning of supply chain functions include the uncertain timing and quantity of returns, the need to balance demands with returns, the need to disassemble the returned products, the uncertainty in materials recovered from returned items, the requirement for a reverse logistics network, the complication of material matching restrictions and the problems of stochastic routings for materials for repair and remanufacturing operations and processing times (Guide at al., 2003).

Steps to Successful Application

- The first step for implementing a CLSC is product collection. This step comprises all the activities required to gather the products that may be distributed over a wide area.
- The second step of implementation is transportation, which corresponds to the management of the flow of products from their origin to a point of storage.

- The third step is warehousing and corresponds to the storage of products before they are put to use.
- The fourth step is sorting, which comprises of the activities that intend either to segregate different products or to segregate among several units of a product on the basis of their condition.
- The fifth step is processing activities that will result in the transformation of products into reusable products and components or into a condition harmless to the environment.

Mazahir (2010) and Steven (2004)

Hints and Tips

- Successful managing of CLSC requires having information systems that support forecasting and control of returned goods in terms of time, quantity and quality (Odeh, 2008).
- Advanced CLSC solutions and infrastructure need to convey correct information to customers and develop marketing schemes to assure them that remanufactured goods have the same quality as new goods (Odeh, 2008).
- Successful Closed-Loop Supply Chain requires strong supplier relationships in order to accommodate the reduction in the amount of purchased parts and components, as well as the changes in design requirements (Guide and Wassenhove, 2003).
- Advanced CLSC solutions are based on product designs that take into consideration the collection, disassembly, maintenance and reassembly of products at the end of their use (Odeh, 2008).

Potential Advantages

- CLSCs pose great environmental benefits and are often synonymous with sustainability. Closing the loop helps to mitigate the undesirable environmental footprint of supply chains (Neto et al., 2009) and increase product differentiation and company market appeal (Blumberg, 2004).
- CLSCs allow companies to more efficiently comply with new sustainability and recycling regulations (Neto et al., 2009).
- CLSCs enable the achievement of economic benefits from re-selling refurbished equipment, spare parts or material (Neto et al., 2009).

Potential Disadvantages

- CLSC have gained significance in a limited amount of industry sectors, including products such as computers, tyres, single-use cameras, photocopiers, car engines and mobile telephones (Guide and Van Wassenhove, 2002).
- A weakness of the Closed-loop supply networks can lie in the uncertainty about the volume of used products returned by customers. This can have a negative effect on collection, remanufacturing, production planning and inventory control (Poles and Cheong, 2008).

- CLSCs can increase company costs due to reverse logistics activities such as remanufacturing, disposal and the need to optimise the total costs (Poles and Cheong, 2008).

Performance Monitoring

- Assessment of manufacturing plants and distribution centres: a scorecard system can be implemented to measure and rank manufacturing plants and distribution centres to help managers understand where to focus their improvement efforts (Payne, 2006).
- Measuring marketing, sales and quality: mathematical models can be used to calculate the rates of expired products (ship life, shelf life, product sales velocity) (Payne, 2006).
- Performance measures: it is not advisable to adopt the performance measures of a traditional supply chain for a reverse/closed-loop supply chain. Instead, mathematical models that use quality function deployment and linear physical programming effectively to measure the 'satisfaction level' of the supply chain could be used (Payne, 2006).

Case Studies

- In the 1990s Kodak began a closed-loop product recovery program. The company facilitated the reuse of parts and components and remanufactured or recycled up to 80% of materials reused. Kodak also reimbursed retailers for a fixed fee per camera and the transportation costs each time a camera was returned to Kodak. As a result, the company reported a return rate of greater than 70% in the United States and almost 60% globally. In total 310m cameras were reused (Guide et al., 2003; Savaskan et.al. 2004).
- As part of their CLSC management effort Xerox Corporation provided prepaid mailboxes to make it easier for customers to return used copy/print cartridges to Xerox without incurring any costs. The company also collects copies as new ones are installed. Overall, the green remanufacturing programme saved the company between 40% and 65% in manufacturing costs through the reuse of parts and materials (Ginsburg, 2001; Guide et al, 2003).
- Cisco has developed a global closed-loop reverse supply chain that allows the company to recover and reuse or recycle the returned electronic equipment in major markets worldwide. In 2009, Cisco received 23.6m pounds of returned product, of which only 0.44% were sent to landfill (non-recyclable materials such as broken pallets, wet cardboard and shrink wrap). The Cisco's Value Recovery group was able to save US$153m by redeploying returned equipment (Cisco, 2009).

Further Reading/References

Web Resources

- Closed-Loop supply Chain: A greener blueprint for industry. http://www.ft.com/cms/s/d0df2f02-6370-11df-a844-

00144feab49a,Authorised=false.html?_i_location=http%3A%2F%2Fwww.ft.com%2Fcms%2Fs%2F0%2Fd0df2f02-6370-11df-a844-00144feab49a.html&_i_referer=#axzz1gPjaeq3x

- The products that never say die. http://www.ft.com/cms/s/5ad24296-657f-11dc-bf89-0000779fd2ac,Authorised=false.html?_i_location=http%3A%2F%2Fwww.ft.com%2Fcms%2Fs%2F0%2F5ad24296-657f-11dc-bf89-0000779fd2ac.html&_i_referer=#axzz1gPjaeq3x
- Closed Loop Supply Chain: The New Consumption Model http://www.wbresearch.com/servicelifecyclemanagement/closed-loop-supply-chain.aspx
- Closed-loop supply and recycling. http://www.theguardian.com/sustainable-business/blog/cradle-to-cradle-green-products-recycling?INTCMP=SRCH
- The Remanufacturing Gazzete (blogspot of the Center for remanufacturing) http://remannews.blogspot.co.uk/2010/06/center-for-remanufacturing-and-reuse.html

Books

- The Handbook of Logistics & Distribution Management, Rushton, Croucher, Baker and the Chartered Institute of Logistics and Chartered Institute of Logistics and Transport, ISBN 978-0749457143
- Managed Closed Loop Supply Chains, Flapper, Nunen & Wassenhove, 978-3642073816
- Reverse Logistics, Dekker, Fleischmann, Indurfurth & Wassenhove, ISBN 978-3642073809
- Closed Loop Supply Chains, Ferguson & Souza, ISBN 978-1420095258
- Introduction to Management of Reverse logistics and Closed Loop Supply Chain Processes, Blumberg, ISBN 978-1574443608

References

- Akcali, E., Etinkaya, S. and Uster, H. (2009) Network Design for Reverse and Closed-loop Supply Chains: An Annotated Bibliography of Models and Solution Approaches. Networks, Vol. 53, pp. 231-248.
- Agrawal, V. and Toktayy, L.B. (2009) Interdisciplinary in closed-loop supply chain management research. Working paper. [online] Available at: (www.prism.gatech.edu/~bt71/articles/chapterv4.0.pdf) [Accessed 25 November 2011].
- Blumberg, D. (2004) Introduction to Management of Reverse Logistics and Closed Loop Supply Chain Processes. CRC Press.
- Cisco (2009) CRS Report: Waste. [online] Available at: (www.cisco.com/web/about/ac227/csr2009/the-environment/waste/index.html) [Accessed 25 November 2011].
- Easwaran, G. and Uster, H. (2009) Tabu Search and Benders Decomposition Approaches for a Capacitated Closed-loop Supply Chain Network Design Problem. Transportation Science, Vol. 43, pp. 301-320.
- Easwaran, G. and Uster, H. (2009) A Closed-loop Supply Chain Network Design Problem with Integrated Forward and Reverse Channel Decisions. IIE Transactions, Vol. 42, pp. 779-792.

- Guide Jr. V.D.R., and van Wassenhove, L.N. (2002). Closed-loop Supply chains. In R.U. Ayres and L.W. Ayres (eds.) A Handbook of Industrial Ecology. Cheltenham: Edward Elgar Publishing.
- Guide Jr. V.D.R., Harrison, T., and van Wassenhove, L.N. (2003) The Challenge of Closed-loop Supply chains. Interfaces, Vol. 33(6), pp. 3-6.
- Guide Jr. V.D.R., Jayaraman, V. and Linton, J.D. (2003) Building Contingency Planning for Closed-loop Supply Chains with Product Recovery. Journal of Operations Management, Vol. 21(3), pp. 259-279.
- Guide Jr. V.D.R., and van Wassenhove, L.N. (2009) The Evolution of Closed-loop Supply Chain Research. Operations Research, Vol. 57(1), pp.10-18.
- Pochampally, K.K., Gupta,S.M. and Govindan,K. (2009) Metrics for Performance Measurement of a Reverse/closed-loop Supply Chain. Business, Vol. 1(1), pp. 8-32. [online] Available at: (www.mendeley.com/research/metrics-measurement-corporate-social-performance/) [Accessed 25 November 2011].
- Kumar, S. and Craig, S. (2007) DELL Inc Closed Loop Supply Chain for Computer Assembly Plants. Information Knowledge Management System, Vol. 6, pp. 197-214.
- Matthews, H.S. (2004) Thinking Outside the Box: Designing a Packaging TakeBack System. California Management Review, Vol. 46(2), pp. 105-199.
- Mazahir, S. (2010) Reverse Logistics and Push/Pull Manufacturing Systems: The Case of High Value Products. Proceedings of the 8th International Conference on Logistics and SCM Research. BEM Bordeaux Management School.
- Nelson, E. (2008) The Business of Old Carpet: The Interface Journey to 2020. Presentation In the International Closed-Loop Supply Chain Workshop. Closed-Loop Supply Chain Management Research, College of Management, Georgia Institute of Technology, 9-11 October.
- Palo, A. (2008) HP Innovates 'closed loop' Inkjet Cartridge Recycling Program Gives Plastic Water Bottles Second Life. [online] Available at: (www.hp.com/hpinfo/newsroom/press_kits/2008/recycled-plastic/) [Accessed 25 November 2011].
- Payne, S. (2006) A Closed-loop Returns Management System Turning Failures into Profits. Available at: (cscmp.org/downloads/public/education/06innovation/KelloggsCSCS.pdf) [Accessed 25 November 2011].
- Poles, R. and Cheong, F. (2009) Inventory Control in Closed Loop Supply Chain Using System Dynamics. Proceedings of International Conference of System Dynamics Society, Albuquerque: NM, USA, 26-30 July.
- Yuanab, G. and Gaoa, Y. (2010) Inventory Decision-making Models for a Closed-loop Supply Chain System. International Journal of Production Research, Vol. 48(15), pp. 4463-4481.

Video

Closed loop supply model: Panel discussion
https://www.youtube.com/watch?feature=player_embedded&v=tKuaUvtpjVY

CIPS KNOWLEDGE

CIPS Group Easton House, Easton on the Hill, Stamford, Lincolnshire, PE9 3NZ, United Kingdom
T +44 (0)1780 756777 F +44 (0)1780 751610 E info@cips.org

CIPS Africa Ground Floor, Building B, 48 Sovereign Drive, Route 21 Corporate Park, Irene X30, Centurion, Pretoria, South Africa
T +27 (0)12 345 6177 F +27 (0)12 345 3309 E infosa@cips.org.za

CIPS Australasia Level 8, 520 Collins Street, Melbourne, Victoria 3000, Australia
T 1300 765 142/+61 (0)3 9629 6000 F 1300 765 143/+61 (0)3 9620 5488 E info@cipsa.com.au

CIPS Middle East & North Africa Office 1703, The Fairmont Hotel, Sheikh Zayed Road, PO Box 49042, Dubai, United Arab Emirates
T +971 (0)4 327 7348 F +971 (0)4 332 5541 E mena.enquiries@cips.org

www.cips.org