



## The Development of Closed-Loop Supply Chains

Wyndham Cramer, Operations Manager, Hewlett-Packard Australia Pty Ltd.  
Runner-up in the 2005 Logistics Development Award, sponsored by CHEP Asia-Pacific.

### 1) Background

Increased levels of consumption are placing a great deal of stress on the natural resources of Australia. The prevailing drought, concerns of air quality in cities, increase in landfill, salinity level in rivers are some of the highly visible phenomena that is driving awareness and consciousness on the need to have sound environmental policies in Australia.

It is becoming clear that unconstrained production and consumption is no longer feasible and as a result businesses are faced with the following issues.

#### a) Public Scrutiny of the Environmental Credentials of Business

Businesses are being increasingly scrutinised on their environmental credentials. There are organisations such as the RepuTex which measures and ranks businesses on how their operations impact on the environment. A high ranking is used by businesses to promote its reputation while an unfavourable ranking elicits a strong response questioning the validity of the ranking.<sup>1</sup> The responses to the ranking given to businesses, either favourably or otherwise may be taken as evidence that corporations are starting to recognise that there is value in being environmentally responsible.<sup>2</sup>

#### b) Government Regulation

A range of state, federal and local government legislation regulates the conduct of businesses in Australia. Current environmental statutes are based on a policing and sanctions approach. Referred to as "command and control", it forces businesses to behave in a manner that is environmentally appropriate by statutory inspections and penalties.<sup>3</sup>

#### c) Focus on Life Cycle and Total Costs

Purchasing specifications are increasingly requiring suppliers to address issues like percentage of recycled content and energy and water efficiency ratings. There is a greater emphasis of life cycle costs as illustrated in the example below.

Figure 1	Product A	Product B	Product C
Initial Cost	\$14000	\$15000	\$16000
Operating/Maintenance	\$7000	\$3000	\$2000

costs for three years			
Disposal Costs	\$3000	\$1000	\$5000
Total Costs	\$24000	\$19000	\$23000

Product B should be selected based on the life cycle costing example above.

Disposal costs are those incurred in sending the product to incineration or landfill. The costs shown above are those internal to the organisation. Assume that the external costs (costs external to the organisation but incurred by the public) of product disposal is \$7000 uniformly for product A, B and C. If the external costs are taken in to consideration the new life cycle costs schedule will be as follows.

Figure 2	Product A	Product B	Product C
Initial Cost	\$14000	\$15000	\$16000
Operating/Maintenance costs for three years	\$7000	\$3000	\$2000
Disposal Costs	\$10000	\$8000	\$12000
Total Costs	\$31000	\$26000	\$30000

The total cost approach considers "externalities" to the business. While there is no evidence that buyers are actively taking externalities into consideration when making product decisions, government regulations are consistently seeking to internalise disposal costs and this is something that business needs to address to remain competitive.

## 2) The Current Definition of Supply Chain Management (SCM)

"Supply Chain Management encompasses the planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third-party service providers, and customers. In essence, supply chain management integrates supply and demand management within and across companies. Supply Chain Management is an integrating function with primary responsibility for linking major business functions and business processes within and across companies into a cohesive and high-performing business model. It includes all of the logistics management activities noted above, as well as manufacturing operations, and it drives coordination of processes and activities with and across marketing, sales, product design, finance and information technology."<sup>4</sup>

## 3) The Closed-Loop Supply Chain

A closed loop supply chain consists of a forward movement of a product at the beginning of its life cycle and its retrieval and reprocessing at the end of its life rather than ending up in landfill or incineration (reverse supply chain).<sup>5</sup>

Existing definitions, (like the one above) of SCM does not explicitly refer to the reverse supply chain and as per Geyer and Jackson, 2004, "is based on a linear production paradigm which relies on constant input of virgin natural resources and unlimited environmental capacity for assimilation of wastes and emissions."<sup>6</sup> Therefore the emphasis is truly on the forward supply chain. Focusing on a closed loop supply chain which includes the reverse supply chain will enable businesses to stand up to the scrutiny by the public, address current regulatory hurdles and prepare business for future regulation. It will also address the commercial reality where disposal costs will gradually become more internalised to the organisation and also where buyers will start adopting a life cycle costs approach towards purchasing decisions.

Closed loop supply chains also reduce the use of primary resources by substituting secondary resources in forward supply chains.<sup>6</sup> Some estimates put a value as high as \$100 billion lost annually by US companies due to the inability to manage the reverse supply chain effectively.<sup>7</sup> Statistics for Australian business is not available but one can assume that based on the US experience, this issue is significant in Australia.

#### **4) The Reverse Supply Chain**

The reverse supply chain can be divided in to five components to enable the analysis of the costs and benefits of different options.<sup>8</sup>

- a) Product Acquisition- The quality, quantity, and timing of product returns need to be carefully managed to avoid being inundated by returned products of variable quality.
- b) Reverse Logistics- This is where products are transported to facilities for inspection, sorting, and disposition. Transportation costs, product handling costs, warehousing costs and the rate of diminution of the value of the returned product will be considered under this category.
- c) Inspection and Disposition- The testing, sorting, and grading of returned products.
- d) Reconditioning- Involves either reconditioning or remanufacturing.
- e) Distribution and Sales- Assessing the costs involved in selling recycled product such as if the existing channels can be used, promotional and marketing activities and the market for recycled product.

#### **5) Change of mindset from a Linear approach to a closed loop Supply Chain - the most significant supply chain trend affecting business in Australia**

Environmental concerns will be the driving force where businesses will be compelled to design products that are more durable and also to take responsibility to dispose of the product at the end of its life cycle without damaging the environment. This will be the primary factor that makes businesses rise to the challenge of designing and implementing closed loop supply chain systems.

Australia's geographical location is characterised by its relative distance from the rest of the world. Within Australia the population is concentrated in major capital cities that are located hundreds of kilometres away from each other. In relative terms Australia's population is very miniscule. Furthermore a large percentage of manufactured products are imported from overseas. The cost of international freight

to ship manufactured goods from overseas to Australia is relatively high. Australian consumers will be priced out of "expensive" manufactured goods due to these reasons. There is an economic case developing for reconditioning or remanufacturing in Australia based on the cost of freight and the substitution of secondary resources which could cost less than 80% compared to when using primary resources.<sup>9 10</sup> This will be the secondary factor that makes business consider closed loop supply chains.

Supply chain managers in Australia have been conditioned over the years towards a linear approach to the supply chain. It is unlikely that closed supply chains will be championed by these managers. Within an organisation the need to change to closed loops will have to be driven by senior management. It is also a fact that there are very few Australian companies that have supply chain personnel at senior executive level and therefore the task of planning and execution of a closed loop supply chain may be quite challenging.

## 6) Conclusion

Australia seems to be a natural candidate for implementation of the closed loop concept for supply chains on a large scale due to two compelling reasons. The first is the environmental concerns in the community which is driving environmentally friendly behaviour in businesses. The second reason is the relative high costs of manufactured goods compared to other OECD countries due to the tyranny of distance, small pockets of isolated population centres and the inability of ever being able to have the scale necessary for manufacturing "new" product locally. Remanufacturing could be as much as 80% cheaper than buying new product (given that the remanufacturing will result in current and not obsolete technology) and taken together with the natural cost disadvantages facing Australia, will make the case further compelling.

In the long term, Australian business will develop the skills and competencies that will set the standard in managing closed loop supply chains globally. In particular there will be sophisticated reverse supply chains developing in Australia which will be studied by other countries in the future.

---

<sup>1</sup> The Reputex social responsibility rating scale is compiled by a project that researches the Australian Top 100 and New Zealand Top 20 organizations as nominated by the BRW annually. The information and data collected from this project provides a public benchmark for social responsibility practices in the Australia Pacific Region.

<sup>2</sup> "Telstra, Caltex say no but will be rated by survey anyway", <http://www.smh.com.au/cgi-bin/common/popupPrintArticle.pl?path=/articles/2003/04/09/1049567738438.html>

<sup>3</sup> Price, I., "Self Regulation", <http://www.aic.gov.au/publications/proceedings/26/prince.pdf>

<sup>4</sup> <http://www.cscmp.org/Terms/glossary03.htm>

<sup>5</sup> Krikke, H, Le Blanc, I; Van de Velde, S, "Product Modularity and the Design of Closed-Loop Supply Chains." California Management Review, 46/2 (Winter2004): 2 charts, 4 diagrams; (AN 12391594)

<sup>6</sup> Geyer, R., Jackson, T., "Supply Loops and Their Constraints: The Industrial Ecology of Recycling and Reuse," California Management Review, 46/2 (Winter 2004): 55-73.

<sup>7</sup> Guide Jr., V., Daniel R., Harrison, T. P., Van Wassenhove, L. N, "The Challenge of Closed-Loop Supply Chains". Interfaces, 33/6, Nov/Dec2003: 3-6.

---

<sup>8</sup> Guide Jr., V. Daniel R., Van Wassenhove, Luk N., The Reverse Supply Chain , Harvard Business Review, Feb2002, Vol. 80, Issue 2

<sup>9</sup> Fleischmann, M, Van Nunen, J.A.E.E, Grave, B., "Integrated Closed Loop Supply Chains and Spare-Parts Management at IBM", Interfaces, 33/6, Nov-Dec 2003. p 46.