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REVERSE SUPPLY CHAIN MANAGEMENT AND SUSTAINABLE DEVELOPMENT

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Reverse Supply Chain is the process of managing the return of goods. Reverse logistics is also referred to as "Aftermarket Customer Services". In other words, any time money is taken from a company's warranty reserve or service logistics budget one can speak of a reverse logistics operation. Sustainable development should satisfy the needs which result from the following areas of human activity: economic, social and ecological.

Economic human needs which result from the abovementioned areas, in the aspect of sustainable development, include:

- services
- development in agriculture and industry
- efficient work management and needs which result from household management.

These elements impact directly economic domains of human activity and give opportunities of improvement in everyday human functioning, supporting their life.

Thus, **sustainable development** consists in maximization of net profits from economic development, simultaneously protecting and ensuring repeatability of usefulness and quality of natural resources in a long run. Economic development must then mean not only rise in *per capita* incomes, but also improvement in other elements of social well-being. It must also encompass necessary structural transitions in economy and in the whole society.

Sustainable logistics chains are based on the concept of logistics ecologic imperative, which treats logistics chains as an arrangement of several or more mutually interrelated links in supply and sale chains which enable realization of the chain needs captured as a whole or as individual links.

The SCMR efficiency can be a tool for building and operating the links established between the actions of environmental protection and economic competitiveness. The logistics transport may have an important role in sustainable mobility through the rational use of vehicles and infrastructure to reduce unnecessary transport.

Efficient Supply Chains: The Centralized Model

The returns supply chain is designed for economies of scale—both in processing and transport of product. Every returned product is sent to a central location for testing and evaluation to determine its condition and issue credit. No attempt is made to judge the condition or quality of the product at the retailer or reseller. To minimize shipping costs, product returns are usually shipped in bulk. Once the condition of the product has been determined, it is channeled to the appropriate area (or facility) for disposition: restocking, refurbishment or repair, parts salvaging, or scrap recycling. Repair and refurbishment facilities also tend to be centralized, often outsourced.

The supply chain is designed to minimize processing costs, often at the expense of long delays. Our research on reverse supply chains indicates that these delays can be excessive.

The centralized, efficient supply chain structure achieves processing economies by delaying credit issuance and testing, sorting, and grading until it has been collected at a central location. This approach has been widely adopted by managers of reverse supply chains, perhaps because it embodies a fundamental design principle of forward supply chains: *postponement*. Postponement—or delayed product differentiation—has been used as an effective strategy for dealing with the cost of variety in forward supply chains¹⁰ Manufacturing and stocking a basic product in generic form and delaying the addition of features, or options, until the product is closer to the customer has been used

Fig. 1 The Impact of Effective and Responsive Reverse Supply Chain Design on EVA

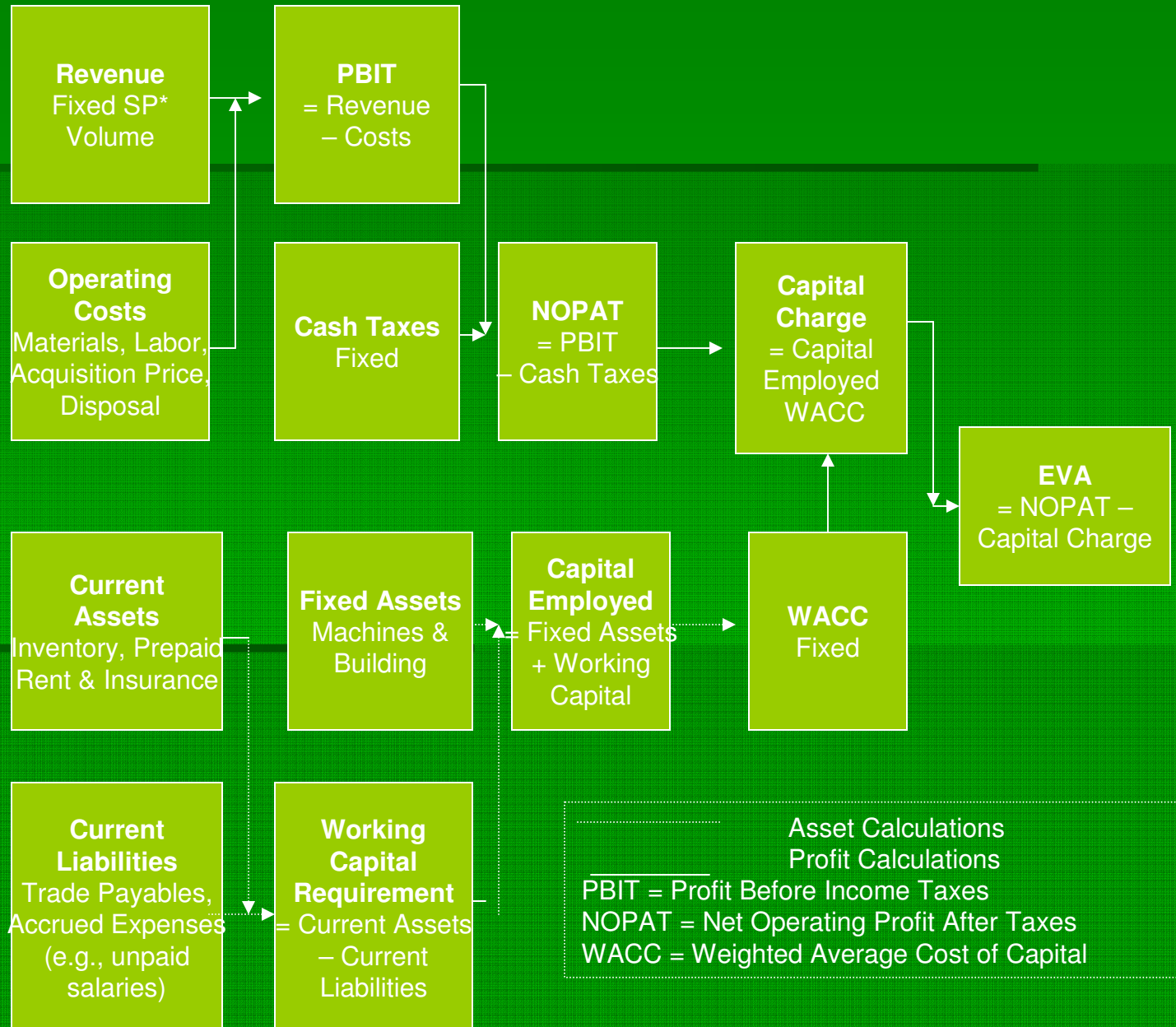
EVA Calculations

Efficient Reverse Supply Chains:

- Lower Operating Costs
- Lower Fixed Asset Investment

Responsive Reverse Supply Chains:

- Increased Operating Costs
- Increased Fixed Assets



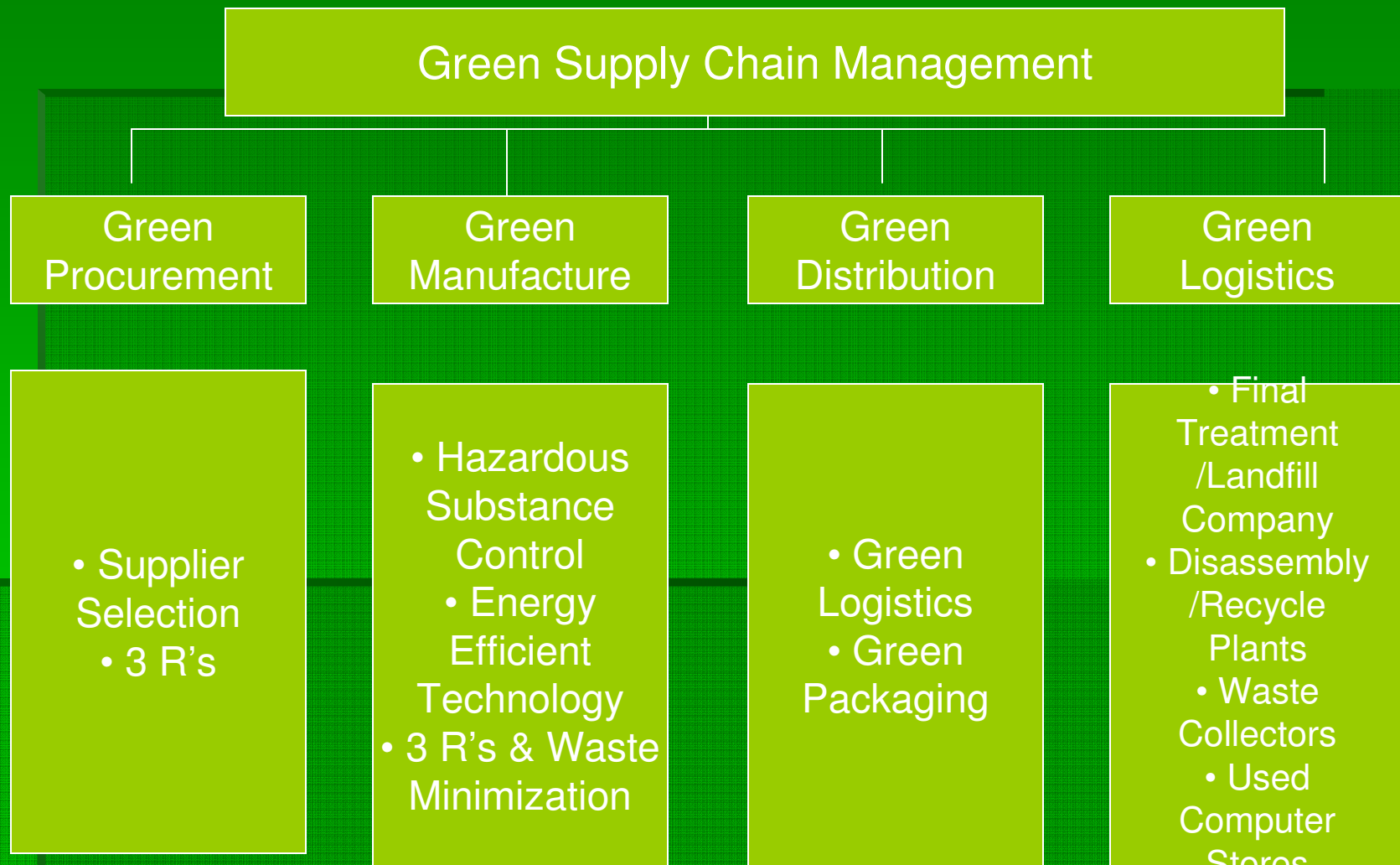
The efficient/effective tradeoff influences the different categories (revenue, costs, fixed and variable assets) differently.

At one end of the scale, efficient chains minimize processing costs, but the accompanying time delays may reduce the value of assets recovered. This is accomplished by lowering operating costs via economies of scale at a centralized facility and the lower fixed asset expense of a single facility

GREEN SUPPLY CHAIN MANAGEMENT

To survey current green activities in computer parts' manufacturers in Thailand, 11 manufacturers are selected for case studies who provide in-depth interview about green procurement, green manufacturing, green distribution, and/or reverse logistics.

Fig 2. Activities in green supply chain of electronics industry



Source: *The Implementation of Green Supply Chain Management Practices in Electronics Industry IMECS, 2010, Hong Kong*

A. Green Procurement

Green procurement is defined as an environmental purchasing consisting of involvement in activities that include the reduction, reuse and recycling of materials in the process of purchasing. Besides green procurement is a solution for environmentally concerned and economically conservative business, and a concept of acquiring a selection of products and services that minimizes environmental impact

The findings in green procurement activities of Thai manufacturers are presented: Supplier selection:

(1) purchase materials or parts only from “Green Partners” who satisfy green partner environmental quality standards and pass an audit process in following regulations for the environment-related substances

(2) consider suppliers who acquire ISO14000, OHSAS18000 and/or RoHS directives

(3) select suppliers who control hazardous substances in company’s standard lists and obtain green certificate achievements

3Rs in procurement process:

- reuse or recycle – paper, parts container (plastic box/bag)
- order via email (paperless)

B. Green Manufacturing

- Green manufacturing is defined as production processes which use inputs with relatively low environmental impacts, which are highly efficient, and which generate little or no waste or pollution. Green manufacturing can lead to lower raw material costs, production efficiency gains, reduced environmental and occupational safety expenses, and improved corporate image

The findings in green manufacturing activities of Thai manufacturers are presented:

- Hazardous substance control:

- (1) lead free – replace other substances such as bismuth, silver, tin, gold, copper

- (2) rinse parts with clean water instead of using chemicals and reuse water

- (3) quality control in inputs at vendor site and recheck before processing

Energy-efficient technology:

- (1) reduce power consumption in products such as ramp load/unload technology in HDD
- (2) increase product life-span resulting in higher efficiency and productivity
- (3) improve machine uptime
- (4) improve machine performance, for example a process of solder jet bonding (using jet in soldering up to 2000 gold balls/hr instead of pressing 500-700 gold balls/hr)
- (5) design product, for example compact design with improved features yet using fewer resources to produce, Strive for higher %recyclability and % recoverability for products as stipulated by WEEE directive, product exterior using bio-based plastics achieves high level of fire redundancy

C. Green Distribution

Green distribution are consists of green packaging and green logistics. Packaging characteristics such as size, shape, and materials have an impact on distribution because of their affect on the transport characteristics of the product. Better packaging, along with rearranged loading patterns, can reduce materials usage, increase space utilization in the warehouse and in the trailer, and reduce the amount of handling required.

The findings in green distribution activities of Thai manufacturers are presented:

- Green packaging:

- (1) downsize packaging
- (2) use “green” packaging materials
- (3) cooperate with vendor to standardize packaging
- (4) minimize material uses and time tounpack
- (5) encourage and adopt returnable packaging methods
- (6) promote recycling and reuse programs

- Green logistics/transportation:

- deliver directly to user site
- use alternative fuel vehicles
- distribute products together, rather than in smaller batches
- change to modal shift

D. Reverse Logistics

Reverse logistics is the process of retrieving the product from the end consumer for the purposes of capturing value or proper disposal [11]. Activities include collection, combined inspection/selection/sorting, re-processing/direct recovery, redistribution, and disposal. The findings in reverse logistics of stakeholders are presented:

- Used computer stores:

- (1) get computer parts 50% from import (e.g. China, Japan and Korea), 30% from auction in organizations, and the rest from household

- (2) generally be small shops with purchase volume up to 40 used computers per month

- (3) the five most reused parts: ram, LCD monitor, CD Rom, CRT monitor and main board

- (4) waste parts treated in different ways: 44% to waste collectors, 26% to walk-in buyers, 26% to store in shop or warehouse, and the rest 4% to garbage

- Waste collectors (called SaLeng) gather EOL computers from community, private/public organization, and used computer store then inspect, select and sort initially to get used parts which are shipped to disassembly/recycle plants. There is lack of obvious database about quantities and value provided in this stage.

- Disassembly/recycle plants collect used computers and parts 50% from manufacturing plants, 20% from community, 20% from waste collectors, and the rest 10% from private/public organization. About 40% of disassembling parts are small electronic parts (e.g. IC, diode, transformer) and materials (metal, glass, plastic) which are derived and sold to big electronic markets. The rest of it are shipped to recycle plants which recycle some precious metals like copper, gold, platinum.

SUGGESTION

According to SCMR, under the conditions of sustainability organizations should:

- establish collection points used to receive goods from the final customer
- to eliminate supply chain assets to achieve an efficiency gain in using the global stock
- to create an environmental packaging and storage systems that will ensure what's left of the value of the product used is not lost and do not affect the environment.