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**REVERSE LOGISTICS AND APPLICATIONS IN THE DEFENSE
INDUSTRY**

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ÖZET

Reverse Logistics And Applications In The Defense Industry

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Sosyal Bilimler Enstitüsü

İngilizce İşletme Yönetimi Anabilim Dalı

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Son yıllarda sürekli ve çok hızlı gelişen çevre sorunları ve ekonomik değişkenler üretici ve perakendicileri maliyet konusunda çok daha etkin sonuçlar alabilecekleri çalışmalara yönlendirmiştir. Ters lojistik bu konularda henüz keşfedilmemiş ve çalışılmamış birkaç alandan sadece birisidir. Özellikle maliyet etkinliği çerçevesinde ters lojistik stratejilerini henüz etkin olarak kullanmamış firmalarının rakiplerine göre dezavantajlı olduğu aşıkardır. Ters lojistiğin etkin olarak kullanıldığı uygulama alanlarından birisi de savunma sanayidir.

Bölgesinde savunma sanayinde oldukça gelecek vaadeden bir ülke olarak Türkiye özellikle mühimmat sanayindeki harcamalarını azaltmak maksadıyla hertür mühimmatın modernize edildiği, yeniden üretildiği, geri kazanıldığı, yok edildiği veya yeniden satılmasının sağlandığı en son teknoloji ve teçhizat ile donatılmış bir projeyi sonlandırmak üzeredir. Avrupa Birliği Çevre Normlarına tamamiyla uygun olan bu proje, NATO'nun lojistik icracısı NAMSA tarafından bir Türk firması olan Roketsan'a ihale edilmiştir.

Türkiye'de ters lojistiğin çevreye uyumu çerçevesinde etkin olarak planlanması ve icrasında her çeşit mühimmatın yeniden kazanım, tekrar kullanılabilirlik, yeniden dağıtım, ve (yakarak) yok edilmesi faaliyetlerinin emniyetli, maliyet etkin ve ölçek ekonomisi çerçevesinde yapılması amaçlanmaktadır.

Anahtar Kelimeler : Lojistik, Ters Lojistik, Maliyet Etkinlik, Silahsızlanma

ABSTRACT

Reverse Logistics and Applications In The Defense Industry

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Ever growing concern for environmental problems and economic pressures for corporate profits are forcing manufacturers and retailers to look very hard at cost controls. Reverse logistics is one of the few remaining opportunities that has not yet received much attention. Firms that develop reverse logistics strategy programs relatively late compared to their competitors are at a disadvantage since it is an untapped strategy especially for cost saving opportunity. One of the effective application areas of reverse logistics is Defense Industry.

In this concern; Turkey as being one of the emerging defense industries in the region is about to finalize a project equipped with the most modern tools and workshops for ammunitions to be modernized, remanufactured, recycled, disposed or resaled to compansate the expenses in Defense Industry. One of the main concerns of this project is being able to compatible with the environmental concern in the norms of EU while processing these activities. This project was awarded by NAMSA, NATO's executive branch about the logistics, to a Turkish firm named Roketsan.

Effective management of these reverse logistics planning and operational activities, compatible with environmental legislation, in Turkey aims to recycle, reuse, resale, redistribute, incinerate or dispose all kinds of ammunition and explosives in a safe, cost-effective and efficient manner in terms of economies of scale.

Key Words : Logistics, Reverse Logistics, Cost Effectiveness, Demilitarization

Reverse Logistics And Applications In The Defense Industry

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ABBREVIATIONS

2D : Two Dimention

3PL: Third (3rd) Party Logistics

3PLP : Third Party Logistics Providers

3PRLP: Third Party Reverse Logistic Providers

AFSOUTH : Air Force South

ANBP : Afghanistan New Beginnings Programme

APL : Anti-Personnel Landmines

ASEAN : Association of Southeast Asian Nations

B2B : Business to Business

BMW : Bayerische Motoren Werkeag

CD : Compact Disc

CEO : Chief Executive Officer

CLM: Council of Logistics Management

COGS: Cost of Goods Sold

CRC : Customer Return Center

CRP: Continuous Replenishment Programs

DC : Distribution Center

DDA : Department for Disarmament Affairs

DFV : Direct Fulfillment Vendor

DPC : Defence Planning Committee

DVD : Digital Versatile Disc

EC : European Commission

EDI: Electronic Data Interchange

ELS : Entegrated Logistics Support

EU : European Union

GDP: Gross Domestic Product

HLM : HAWK Logistics Management

HQ : Headquarter

HVAC: Heating Ventilation and Air Conditioning

IAER: International Association of Electronic Recyclers

IBC: Intermediate Bulk Containers

IBM : International Business Machines Corporation
IMAS : International Mine Action Standards
IO: Input-Output
IT : Information Technology
KPC : Koblenz Procurement Centre
LAN : Local Area Network
LTL: Less Than Truckload
MC : Military Committee
MMC : Materiel Management Centre
NAC : North Atlantic Council
NAMSA : NATO Maintenance and Supply Agency
NAMSO : NATO Maintenance and Supply Organization
NATO : North Atlantic Treaty Organization
NCA: National Candy Association
NNTC : NAMSA NIKE Training Centre
NPM: Net Profit Margin
NSC : NATO Supply Centre
OB : Open Burning
OD : Open Detonation
OEM : Original Equipment Manufacturer
OSCE : Organisation for Security and Cooperation in Europe
OSPAR : The Convention for the Protection of the Marine Environment of the North-East Atlantic
P&G : Procter and Gamble
PC : Personal Computer
PfP : Partnership for Peace
PLC : Product Life Cycle
PMO : Programme Management Offices
PoA : UN Programme of Action to Prevent Combat and Eradicate the Illicit Trade in Small Arms and Light Weapons in All Its Aspects
POS: Point Of Sale
RD: Reverse Distribution
R&D : Research and Development
RF : Radio Frequency
RFID : Radio Frequency Identification

RL : Reverse Logistics
RLEC : Reverse Logistics Executive Council
RMA : Return Material Authorization
RMDS/G : Regional Micro-Disarmament Standards and Guidelines
ROA: Return on Assets
ROI: Return on Investment
RONW: Return on Net Worth
SADC : Southern African Development Community
SADU : Small Arms Demobilization Unit
SALW : Small Arms and Light Weapons
SCM : Supply Chain Management
SD : Southern Depot
SEESAC : South Eastern Clearing House for the Control of Small Arms and Light Weapons
SOC : Southern Operational Centre
SPL : Service Parts Logistics
SCPM : Supply Chain Process Management
TAF : Turkish Armed Forces
UNDP : United Nations Development Programme
UPC : United Parcel Service
US: United States
USA : United States of America
VCR : Video Cassette Recording
VMI: Vendor-Managed Inventory
WAN: Wide Area Network
WMS : Warehouse management system
WERC: Warehousing Education and Research Council

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INTRODUCTION

The emergence of the global economy and intensified competition have led many firms to recognize the importance of the effective logistics management. The effective usage of logistics systems will be one of the primary competitive advantageous driving force in the near future. Thus logistics is one of the key concepts with augmented importance in gaining competitive advantage.

Logistics management is the process of planning, organizing and executing the efficient, effective flow and storage of goods, services and related information from the place of origin to the place of consumption or application for the purpose of optimally meeting customer and client requirements in order to help maximize the long-run welfare of the organization.

While logistics principles are the same domestically and globally, operating environments are more complex and costly. Primary emphasis is on quick, accurate, efficient fulfillment of demand. However, there's another consideration that needs to be factored into the strategic equation which is called reverse logistics. Besides, ever growing concern for environmental problems, and pressure from the global competitive marketplace toward further improvement of customer service, have also been presenting industries with this new challenge of the development and management of effective reverse logistics processes.

Reverse logistics activities include; processing returned merchandise for reasons such as damage, seasonal, restock, salvage, recall, or excess inventory, recycling packaging materials and reusing containers, reconditioning, remanufacturing and refurbishing products, obsolete equipment disposition, hazardous material programs and asset recovery. The types of items that come back and require reverse logistics processing may include product returns, product recalls, end-of-lease equipment, old/obsolete items being replaced, packaging materials and myriad other items.

Reverse logistics is an excellent strategic source of value added revenues. Manufacturers, distributors and retailers are struggling with this challenge of reverse supply chain. Product returns handling is an important process of the supply chain that

is not well handled. Economic pressures for corporate profits are forcing manufacturers and retailers to look very hard at cost controls. Reverse logistics is one of the few remaining opportunities that has not yet received much attention. In this first section; development process of logistics and reverse logistics concepts, their application areas and difficulties in the processes were explained.

In the second section; some of RL strategies, their application areas and the possible results that can be gained after the executions of them is explained. These strategies are named as: collaboration in RL for competitiveness, growth strategy and source-reduction strategies as part of a RL, creating value through RL, design of RL network, process reengineering to reduce cycle time and improve customer service quality through speed in RL, 3PLs service and characterization of RL networks for 3PLs. All of these strategies have a extend number of usage under different conditions and circumstances in different structured firms and organizations practicing RL.

The application of this study can be classified in Heavy Industry due to its relation with the Defence industry and one of its main concerns –ammunition-. But it is a completely special industry and requires special evaluation and treatment at all. Because; there is little reliable information about the size of ammunition or other conventional ammunition stockpiles. Ammunition production and stocks are generally classified as secret for national security or commercial reasons. But information about ammunition stocks can raise greater sensitivity in armed forces, since it may relate to sustainability of military operations.

The presence of explosives, toxic materials or propellants means that disposal or destruction of ammunition are relatively hazardous, and require much more detailed technical and expert response. Moreover, for large scale or on-going destruction programmes, it becomes more efficient to develop an industrial demilitarisation facility for the purpose. This requires time and substantial resources, including donor resources for many developing countries. This sort of facility requires infrastructure investment, staff training and demilitarisation equipment procurement also.

Growing consumer awareness of recycling within the evolving environment coupled with more stringent state and local regulations on waste disposal necessitated Turkey to develop an infrastructure and a modern facility to meet post-distribution and

post-consumption activities of ammunition in Defence Industry such as recycle, resale and dispose options for the opportunities of revenue generating and even contributing to balance the huge disparity of the region continuing between the needs and response in this sector.

Like the other big actors of defense industry nations, one of Turkey's greatest challenge is to reduce the large and growing stockpile of ammunitions that have been designated for demilitarization.

In the third section it was aimed to provide information about the scale and importance of ammunition issue in the Defence Industry, to describe demilitarization processes for different kinds of ammunition, to specify the principles of managing these processes, to describe demilitarization requirements during the execution of the processes, to characterize the demilitarization stockpile and specify the succeeding processes and to describe opportunities for recycling materials from the stockpile in this newly established facility. This most recent and most modern project was awarded by NAMSAN and contracted to a Turkish Roketsan firm to be finished by the end of year 2007. Lastly, some recommendations for the RL process and solutions are proposed for some certain problem areas and to the industry.

Turkish Ammunition Renovation, Improvement, Disassembly and Shell Center (TARIDSC) facility was projected to get modernized and additionally Disassembly and Shell Facilities planned to be founded in Turkey. By the end of these projects; Turkey will be able to cope with one of the biggest challenge of Defense Industry, which is the large and growing stockpile of ammunition that have been designated for demilitarization within the environmental concerns.

In this concern it can be concluded that; reverse logistics is and will continue to be a growing field and should be viewed as an integral part of the organization's overall supply chain. With the proper strategies and metrics in place, reverse logistics should be part of the larger product and customer lifecycle strategies and can serve as a foundation for revenue generating, cost effectiveness, establishing customer loyalties and increasing market share in the business.

SECTION 1

DEVELOPMENT PROCESS OF LOGISTICS CONCEPT

1.1. Definition of the term “Logistics”

Increasing competition in the business world and more sophisticated consumer service requirements led to the realisation that product competition would in the future take place through strategically arranged logistic management, rather than through individual firms operating in isolation.

The emergence of the global economy and intensified competition have led many firms to recognize the importance of the effective logistics management. The effective usage of logistics systems will be one of the primary competitive advantageous driving force in the near future. Thus logistics is one of the key concepts with augmented importance in gaining competitive advantage (Yıldıztekin, 2002).

The public sector and private business management world is currently gaining because of developments in logistics. In addition modern computer system make it possible for organizations to continuously improve all their logistics activities. Organizations can now hold smaller inventories and transport systems are effectively linked to the operations of organizations. Modern computerised warehouses and handling equipment are being used and improved procurement systems are developed to enhance the flow of materials from the raw material stage through the logistics chain to the end user. The same principles apply to public and non-government organizations to manage their incoming and outgoing goods and service flows more efficiently. This has a positive effect on customer/client service and ultimately on user satisfaction (Vogt, Pienaar & De Wit, 2002; 82).

The word logistics is derived from the Greek adjective *logistikos*, which means skilled in calculating, relating to arithmetic or which is concerned with reason. The Greek *logistikos* entered the main European languages via the Low Latin *logisticus*, which became *logistique* in French. The word *logistique* was recognized by the French Academy in 1840 to describe the art of combining and coordinating the quartering, means of transport, supplying and supporting of troops through reasoning by calculation during a military campaign. After the

Napoleonic wars the term logistics, in a military context, was also adopted in other European languages (Dictionnaires Le Robert, 1976; 284).

Since the Second World War the meaning of logistics has been extended to fields other than the military and has also been used in a management context since the early 1960s. In this context logistics can be described as the process of planning, organizing and executing the efficient, effective flow and storage of goods, services and related information from the place of origin to the place of consumption or application for the purpose of meeting customer and client requirements optimally in order to help maximize the long-run of the organization (Dictionnaires Le Robert, 1996: 305).

In 1986 the Council of Logistics Management (CLM) the major logistics professional organization in the USA, defined logistics as “the process of planning, implementing, and controlling the efficient, cost effective flow and storage of raw materials, in-process inventory, finished goods, and related information flow from point of origin to point of consumption for the purpose of conforming to customer requirements (CLM, 1986; 104).

In 1991 the CLM recognized the importance of services flows and modified its definition of logistics to “the process of planning, implementing , and controlling the efficient, effective flow and storage of goods, services and related information from the point of origin to the point of consumption for the purpose of conforming to customer requirements (CLM, 1991; 53)”. The CLM stresses that; this definition includes inbound, outbound, internal, and external movements, and return materials for environmental purposes.

If an organization can consistently provide its customers and clients with the desired quality and quantity of products, where and when needed, at acceptable cost, it can gain market share advantage over its competitors. The organization might be able to sell its products at a lower cost as a result of logistics efficiencies, or provide a higher level of customer and client service as a result of logistics effectiveness, or both, thereby gaining a competitive edge in the market.

Logistics management is the process of planning, organizing and executing the efficient, effective flow and storage of goods, services and related information from the place of origin to the place of consumption or application for the purpose of optimally meeting

customer and client requirements in order to help maximize the long-run welfare of the organization.

In 1998 the CLM modified its 1991 definition as follows: “Logistics is that part of the supply chain process that plans, implements, and controls the efficient, effective flow and storage of goods, services, and related information from the point of origin to the point of consumption in order to meet customers requirements (CLM, 1998; 44).

Logistics management as defined by the CLM (Ackerman, 2005) is focusing on customers and enhanced management of planning, executing, transportation, warehousing, and controlling of material, service and information flows from raw materials to finished goods in the supply chain to fulfil the customer needs.

These above definitions of logistics do not change the meaning of the concept as contained in the 1991 definition of the CLM, they just add that logistics is a subset of the supply chain process. The CLM does not, however, define its understanding of the supply chain process in its latest definition of logistics.

1.2. Supply Chain Management (SCM) Definition

The global economy has changed dramatically during the last few years in response to new technological, financial, and political conditions. Today's companies are struggling to cope with the new economy's more stringent business and operational conditions including mercurial markets, ever-slimmer margins, highly discerning customers, and heavy dependence on trading partners as a result of outsourcing over the years. Business executives have recognized that operational excellence is critical to achieving long term, sustainable competitive differentiation. Smart companies in manufacturing industries are pursuing various strategies to increase productivity, efficiency, effectiveness, customer loyalty and quality.

The trend of outsourcing over the last 10 years has dramatically altered corporate structure. The transformation from vertically integrated operations to virtually integrated operations means that fundamental operational data is no longer immediately accessible. Data critical to operational efficiency is now originated by customers (e.g., demand

forecasts), suppliers (e.g., parts and raw material availability), and outsourcing partners such as 3PLs and 4PLs (e.g., delivery dates). Operational efficiency also requires that managerial decisions be precise and based not only on specific details of a particular issue, but also on a global view of tendencies and performance indicators across the extended enterprise. In this new extended enterprise structure, SCM is all about sharing such data with one's trading partners. This new structure compels companies to collaborate to improve their own efficiency (Manghirmalani, 2003; 317).

In a customer focused business, a time-definite and reliable supply-chain system is critical. Effective SCM is an intricate loop, one that begins with the customer and ends with the customer. In earlier days, the phrase SCM meant assembly lines, warehouses, truckers and time sheets. Traditionally, marketing, distribution, planning, manufacturing, and purchasing organizations operated independently along the supply chain. These organizations functioned with their own objectives which were often conflicting. The imbalance in the entire practice demanded for a mechanism which integrates different functions together. SCM is a strategy through which such integration can be achieved (Porter, 1996; 63).

All the possible objectives for a company —market agility, reducing margin pressure, cost cutting, increasing customer loyalty, cycle-time reduction, and trading partner collaboration—are directly related to the efficiency with which a company's Supply Chain is Managed (Manghirmalani, 2003; 317). An effective supply-chain mechanism helps organizations achieve significant operational excellence throughout the extended supply chain, that maximize revenue and minimize expense.

A supply chain is a network of facilities and distribution options that performs the functions of procurement of materials, transformation of these materials into intermediate and finished products, and the distribution of these finished products to customers. Supply chains exist in both service and manufacturing organizations, although the complexity of the chain may vary greatly from industry to industry and firm to firm. To survive in the present global competitive environment, organizations need to show a heightened awareness to customers' needs (Bell, 2003; 54).

SCM is the oversight of materials, information and finances as they move in a process from supplier to manufacturer to wholesaler to retailer to consumer. Supply chain management involves coordinating and integrating these flows both within and among companies (Fearne, 2002; 2).

SCM is typically viewed to lie between fully vertically integrated firms, where the entire material flow is owned by a single firm and those where each channel member operates independently. Therefore coordination between the various players in the chain is a key to its effective management.

Supply chains comprise vertical and horizontal structures that facilitate the forward flow of products or services and are dependent on accurate and timely upstream information flows (Min and Zhou, 2002; 234). Every supply chain is comprised of a number of exchanges that are impacted by internal and external forces (Zenger, Lazzarini and Poppo, 2002; 282) which relate to and impact a supply chain's performance, processes, practices and context. Supply chains develop competitive advantage in the market that they serve by exploiting linkages between chain participants (Porter, 1985; 47) involved in product and / or information exchange (Stuart, 1997; 548). The very basic supply chain is illustrated in figure 1.1. below.

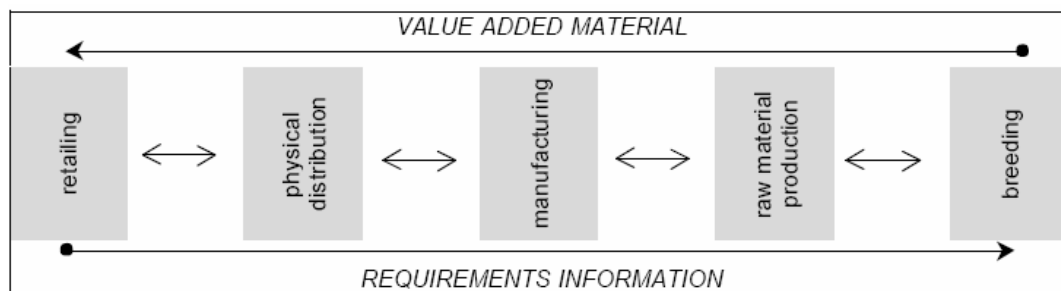


Figure: 1.1. Basic Supply Chain

Source : Fearne, A. and Hughes, D. (2002). *Supply Chain Partnerships in a Global Food Industry: Towards a Sustainable Competitive Advantage*.:2.

Simply, supply chain management consists of the coordination of demand and supply of products and services between a suppliers' supplier and a customers' customer. It involves the flow of product, information, and money between the 'trading partners' of a

company's 'supply chain'. Stages in the supply chain and flows between the stages can also be illustrated as figure 1.2. (Suresh, 2004; 2).

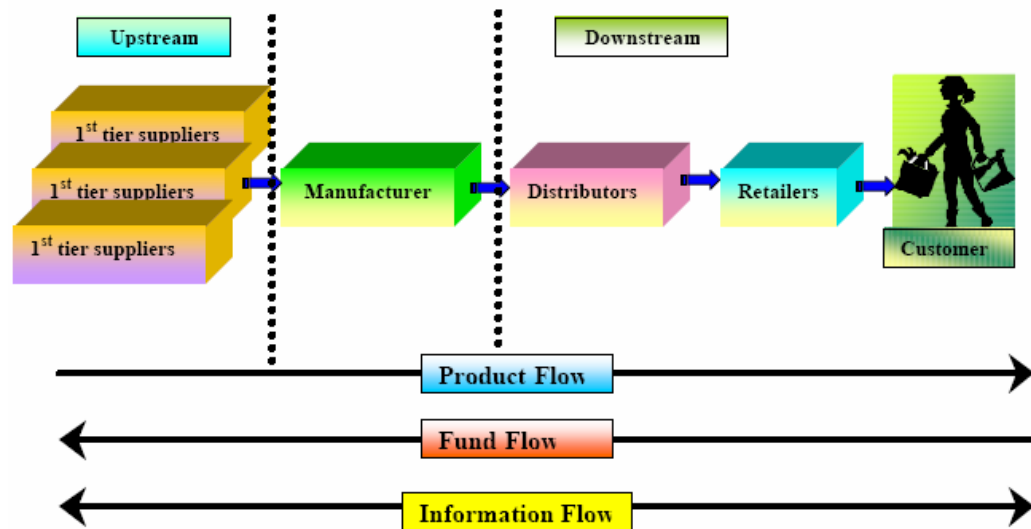


Figure: 1.2. Stages in The Supply Chain

Source : Fearne, A. and Hughes, D. (2002). *Supply Chain Partnerships in a Global Food Industry: Towards a Sustainable Competitive Advantage*.:2.

To define the term "Supply Chain Management" in the simplest way; it is better to pull apart the parts of the term and begin with Supply-Providing goods, services and knowledge; Chain - Across several entities that are linked; and very common and often used term especially in social sciences Management - Infers " Pro-activity" (Suresh, 2004; 3).

So the term "Supply Chain Management" can be defined as; the proactive act of improving the efficiency and effectiveness of the flow of goods, services and knowledge across all stake holders with the goal of reducing total cost and obtaining a competitive advantage for all parties (Suresh, 2004; 4).

1.2.1. Principles of Supply Chain Management

When setting out a supply chain, as with everything else in life, the first consideration must be the objective. By definition, a "Supply chain" exists to supply something to someone. That someone is the ultimate customer, usually a consumer, but

perhaps a patient, a soldier, a police officer or some other public servant. To understand the idea of supply chain management (SCM) it is helpful to relate this to six key concepts expressed as principles as summarised in table 1.1. (Beesley, 1997; 2).

The key principle is end user focus, the recognition of the dominance of the consumers of the ultimate product or service at the end of the chain. SCM recognises, first, the alignment of all the successive enterprises in the chain to relate their inputs directly to satisfying the end user. No two people have precisely the same need and aspiration, but users can be grouped into different classes within which needs are very similar. Hence the second principle, the segmenting of the market into distribution channels and designing individual logistics systems to satisfy each. These ideas have been current since the 1970's and remain the foundation of present day SCM (Beesley, 1997; 2).

In today's global competitive market, first class products no longer guarantee success in the aggressive battle for market share. To be successful, organizations need to increase their productivity and reduce costs. To survive in the present global competitive environment, organizations need to show a heightened awareness to customers' needs. Hence, there is an increased focus on a customer-centric business models and integration of supply chains to enable collaboration between the supply chain partners (Kulkarni, 2006; 1). There are many cases for collaboration between 2-firm supply chains, like Procter&Gamle and Wall-Mart (Poirier, 1999; 145). The evolving, environment are forcing the companies toward the establishment of supply chain integration.

Companies implementing SCM may realize benefits of SCM as: reduced inventory and distribution costs, faster time-to-market, lesser market risks through effective co-ordination and communication, improved quality of product/service, effective inventory management, increased ability to implement just-in-time delivery, increase in on-time deliveries, increased factory responsiveness, reduced order cycle time, increased revenue, better visibility of processes, and added competitive advantage (Hicks, 2000; 182).

Table 1.1. Supply Chain Principles

The Principle of SC	Nature of the Principle in the Context of SCM
End User Focus	Long-term supply chain profitability is dependent on the end (ultimate) user being satisfied. This acts as the focus for all supply chain design, development and process engineering.
Horizontal Boundary Definition	Different end user needs are more competitively satisfied by channels (horizontally defined routes or workflow) designed and engineered ideally across the Supply Chain from a logistics service perspective.
Vertical Boundary definition	Boundaries of ownership and control (dividing the chain vertically) should be positioned to suit the needs of the end user according to best practice and make buy theory.
Inventory Positioning	The positioning and levels of inventory are best determined in a total Supply Chain context to suit end user needs inline with stock and postponement theory.
Controlling Demand Dynamics	Understanding and levels of control over Demand Dynamics is best achieved by having a holistic supply chain perspective. The principle basis is through information integration and the use of best practice relationship management.
Co-Operation And Co-Ordination	The attainment of the above principles requires co-operation and co-ordination between supply chain participants must have self-defined and motivating objectives on trust and some common business aspirations.

Source: Beesley, Adrian P. (1997), *Time Compression in the Supply Chain, Global Logistics and Distribution Planning*, Kogan Page.

From the early days of supply chain management the term has not had a clear definition. One of the reasons for the lack of a universal definition of supply chain management is the multi-disciplinary origin and evolution of the concept (Croom & Giannakis, 2000; 69). The term originally was defined as the flow of materials within an organisation and the relationship between functions Oliver and Webber (1992; 67). This theme was continued by Stevens (1989; 5) who found; those functional attitudes and goals

in most companies are in conflict and hinder integration along the supply chain. Porter (1985; 42) used the term “Value Chain” stating that a firm may be able to draw unit boundaries more in tune with its sources of competitive advantage and provide for the appropriate types of co-ordination by relating its organisational structure to the value chain, and linkages within it and with suppliers or channels. Hines (1997; 48) in turn used the term “Value Stream” concluding that the difference between the traditional supply chain or value chain and the value stream is that the former includes the complete activities of all the companies involved, whereas the latter refers only to the specific parts of the firms that actually add value to the specific product or service. This brief summary of what is now known as the Supply Chain confirms the assumption that the terms used are general and open to interpretation.

1.3. Comparison of Logistics and SCM Terms

Defining SCM is to be more of a challenge than it is thought. No two textbooks seem to offer the same explanation as authors often take a functional perspective that is steeped in logistics, operations management, or another field. Also, numerous articles have debated the issue of supply chain versus logistics, supply chains versus value chains, SCM versus demand management, and even the appropriateness of the word “chain” (Gibson & Cook, 2003; 129).

SCM remains an important topic among logistics managers, researchers and educators. Given this vast array of definitions and perspectives, it's not surprising that educational institutions, professional associations, and organizations are taking numerous approaches to SCM. Perspectives of practitioners and academicians regarding the pertinent issues including; the role of SCM in the organization, activities included in SCM, logistics educational programs approach to SCM, logistics professional associations approach to SCM (Larson & Halldorsson, 2004; 17).

On the educational side, the unclear conceptual boundaries of SCM make it difficult to design educational and research programmes in SCM without large overlap with other fields such as logistics, marketing, operations management and purchasing. Moreover, it is difficult to implement SCM unless it is well defined (Larson & Halldorsson, 2004; 18).

Two universities, in conjunction with an international logistics professional association, conducted an Internet-based survey to explore these issues. In June 2003, 6,422 members of this professional association received an e-mail request to participate in a survey regarding the nature and scope of SCM. As of July 1, 2003 approximately 11.3% (725) of these individuals had completed the online survey. The majority of the respondents are employed by one of four types of employers: manufacturing firms 32%, 3PL providers 16%, consulting firms 16%, and universities 10%. When asked about their views regarding the role of SCM in an organization, the majority (73%) felt that it encompasses both strategic and operational activities. Smaller groups felt that SCM is a strategy that transcends activities (16%) or a corporate function (9%) (Gibson & Cook, 2003; 129).

Further questions about SCM activities revealed that logistics professionals do not believe that they are limited to the traditional plan-buy-make-move perspective. A large proportion of respondents felt that each of the following activities – finance, information technology, marketing, product design, sales, and collaboration – is either encompassed or influenced by SCM. Four-fifths of the respondents felt that supply chain partner collaboration is encompassed by SCM. Approximately 57% of respondents felt that finance and sales are influenced by SCM and approximately 47% of respondents felt that information technology, marketing and product design are influenced by SCM.

Next, respondents were asked to consider two different definitions of SCM and assess how accurately each depicted their perspective. The alternative definitions were: (Gibson & Cook, 2003; 130).

SCM 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, SCM integrates supply and demand management within and across companies.

SCM encompasses the planning and management of all activities involved in sourcing and procurement, conversion, **demand creation and fulfillment**, and all Logistics Management activities. Thus, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third-party service providers, and

customers. In essence, SCM integrates supply and demand management within and across companies.

Respondents felt that both SCM definitions presented in the survey provided somewhat accurate depictions of SCM with both definitions receiving an average of approximately 5.5 on a 7-point scale (where 7 = very accurate depiction). However, when forced to choose between the two definitions, 56% of respondents chose the second definition that included “demand creation and fulfillment (Gibson & Cook, 2003; 133).

When asked if university logistics programs and professional logistics associations should adopt a broader supply chain focus, 70% of the respondents agreed or strongly agreed. The respondents also felt that these organizations should retain a strong emphasis on logistics functional integration. However, the trend toward changing titles from logistics to SCM was not perceived by the respondents as being critically important (Gibson & Cook, 2003; 135).

In summary, these survey results indicate that logistics professionals strongly agree that their discipline is broadening in scope. As a result, they are urging logistics educators and logistics professional association administrators to broaden their scope. In addition, logistics professionals believe that SCM has both strategic and operational aspects and, at a minimum, influences many major corporate functions. However, there appears to be no broad consensus among logistics professionals regarding a definition of SCM or which corporate functions are encompassed by SCM. But the challenge still remains.

But there is lack of agreement on how SCM is related to logistics. Following are four conceptual perspectives on SCM versus logistics are illustrated at figure: 1.3. : traditionalist, relabelling, unionist and inter-sectionist (Larson & Halldorsson, 2004; 18).

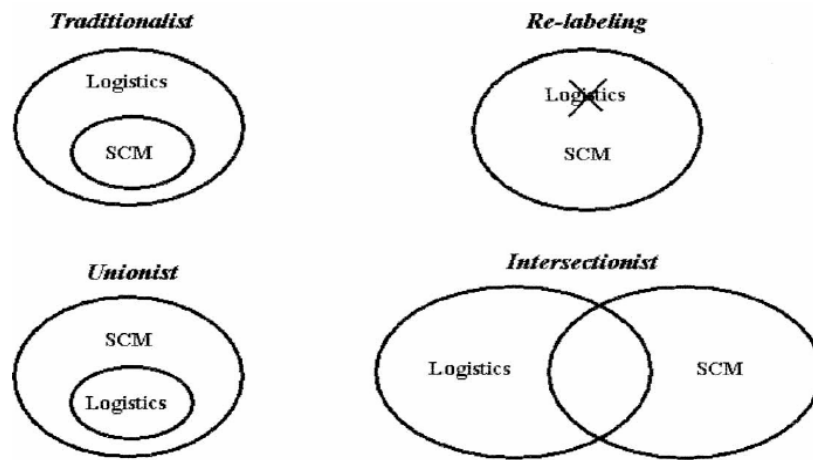


Figure: 1.3. Perspectives on Logistics versus SCM

Source : Larson, Paul D. & Halldorsson, Arni. (2004). Logistics Versus Supply Chain Management : An International Survey. *International Journal of Logistics: Research and Applications* Vol. 7, No. 1.

1) Traditionalist : The traditionalist positions SCM within logistics, i.e. SCM is one small part of logistics. Lambert & Stock (2001; 127) observed that the logistics community has tended to view SCM as “logistics outside the firm”. This reduces SCM to a special type of logistics, external or inter-organisational logistics.

2) Relabelling : The relabelling perspective simply renames logistics; what was logistics is now SCM. Leenders & Fearon (1997; 47) describe “logistics management, or supply chain management” as an organisational strategy. Tan et al. (1998; 4) discuss an evolution of logistics into “integrated logistics”, which is now often called “SCM”. According to Jones & Riley (1985; 19), SCM techniques “deal with the planning and control of total materials flows from suppliers through end users”. This notion of SCM overlaps heavily with the CLM definition of logistics. Simchi-Levi et al. (2000; 22) “do not distinguish between logistics and supply chain management”. They also use supply chain and logistics network as synonymous terms. Relabelling narrows the scope of SCM, since SCM equals logistics. In the world of logistics practice, last year’s “logistics analyst” may be this year’s “SCM analyst”, with no change in job description.

3) Unionist : This perspective treats logistics as a part of SCM; SCM completely subsumes logistics. Giunipero & Brand (1996; 32) expressed this view with the following statement: “SCM is more than logistics”. According to Konezny & Beskow (1999; 17), the

components of SCM are: logistics (inventory, warehousing, packaging, distribution, transportation, customer service, purchasing, production planning and demand forecasting); strategic planning; information technology; marketing; and sales. Others develop SCM as an interdisciplinary concept drawing on fields such as marketing, economics, logistics and organisational behaviour (Hobbs, 1996; 19).

4) Inter-sectionist: The intersection concept suggests SCM is not the union of logistics, marketing, operations management, purchasing and other functional areas. Rather, it includes strategic, integrative elements from all of these disciplines. Giunipero & Brand (1996; 34) hinted at this idea with the following statement: “SCM is not a subset of logistics but is a broad strategy which cuts across business processes both within the firm and through the channels”

Despite a growing base of literature and experience, there appears to be no consensus on the relation between logistics and SCM. Cooper et al. (1997; 4) recognise multiple perspectives on logistics versus SCM, noting “practitioners and educators have variously addressed the concept of SCM as an extension of logistics, the same as logistics, or as an all-encompassing approach to business integration”. They also suggest that SCM “can be the management of all business processes” (Larson & Halldorsson, 2004; 21).

1.4. Reverse Logistics (RL) Definition and Process

For a number of decades, industries have been concentrating on development, implementation, and management of forward logistics processes to reduce operational costs.

The forces driving globalization are many, main ones being; economic growth (expanding market share, to obtain access to low-cost and/or high quality labor, material and production capacity), regionalization, deregulation of transportation, logistics firms' perspective and strategy, technology, etc. Whereas an effective logistics system and application of appropriate marketing strategies is useful for domestic operations it is essential for global operations. While logistics principles are the same domestically and globally operating environments are more complex and costly. Cost and complexity are described as 4Ds -- distance, documents, diversity in culture and demands of customers.

Distances are longer. Documentation is more extensive. Cultures and therefore the demands for different customer groups vary widely. The operating challenges faced by global logistics systems vary significantly within operating regions. Therefore developing appropriate marketing strategies to respond to global 4D environment is hard and a complex process for logistics management (Tanyeri and Tavmerger, 2004; 15).

Customer responsiveness, speed to market, automatic replenishment are the buzzwords commonly applied to today's supply chain logistics strategies. Primary emphasis is on quick, accurate, efficient fulfillment of demand. However, there's another consideration that needs to be factored into the strategic equation which is called reverse logistics (Richey, Daugherty, Genchev & Autry, 2004; 22).

Ever wondered what happened to the book returned to "amazon" because it was not what it was ordered or came with a few pages missing? Or to the television returned to the store since it never turned on the first time it was tried? What happens to that bottle of Coke? What happens to those empty drums of fuel and chemicals at the factory? These are the members of Reverse Logistics world.

Ever growing concern for environmental problems, and pressure from the global competitive marketplace toward further improvement of customer service, have been presenting industries with this new challenge; which is the development and management of effective reverse logistics processes (Mohanamad & Retzlaff, 2002; 137).

For years, returned merchandise was generally viewed as a headache for both the seller and the buyer. But innovative thinking combined with a desire to find a profitable opportunity has put a lot more focus recently on reverse logistics (Tibben-Lembke, 1998; 38).

Reverse Logistics by its nature is a very complex and specialized area of any supply chain. No matter what the product is, how it is sold, or who the customers are, every company needs to focus on recovering the greatest value from returns. All of this while maintaining customer loyalty, controlling cost and harvesting information that helps reduce returns in the future (Tibben-Lembke, 1998; 41).

The concept is broad and encompasses a number of activities within logistics and other functions carried out within supply chains. A flow model of the major events or activities that occur within reverse logistics is presented in figure 1.4. (Stock, 2004; 53).

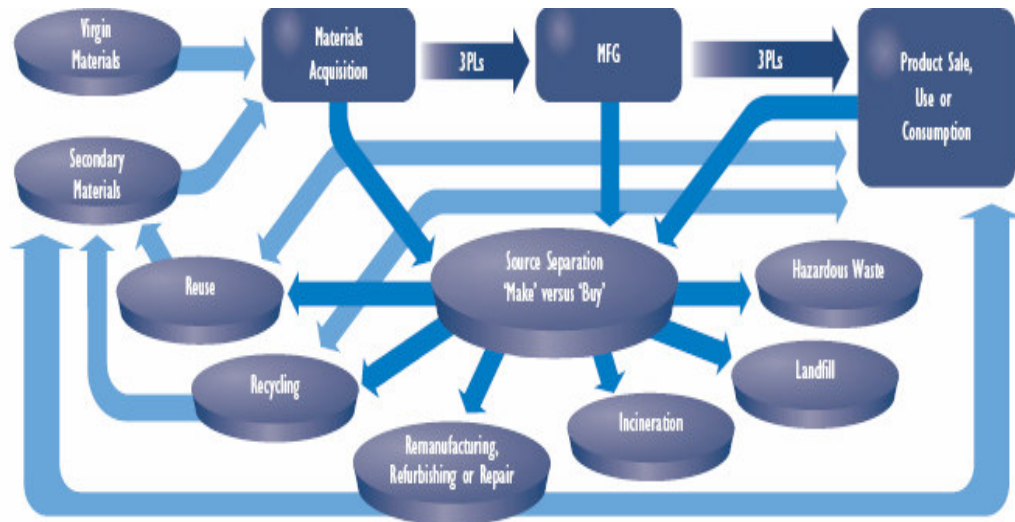


Figure 1.4. : A Flow Model of The Major Activities Occuring within RL.

(Source: Stock, J.R. (1998). Development and Implementation of Reverse Logistics Programs. *Council of Logistics Management*, Oak Brook, IL.

Reverse logistics can be defined as “the neglected child in the extended family of the supply chain” in many ways. For many companies the priorities lie in making sure goods get out, not on managing their return in an efficient manner. Others are distracted by the fact that returns can be expensive and hard to administer. Returns have traditionally been dealt with as exceptions within the normal operation of core supply chain processes and IT systems. However, as the desire to improve competitiveness, quality, customer service, reverse logistics has assumed ever greater importance (Daga, 2005; 3).

In evaluating the importance of logistics within supply chains, many published lists of logistics attributes have reverse logistics rated relatively low in importance. Such ratings are, however, misleading. Product quality, competitive prices, consistent order cycle times, ontime deliveries and low damage rates have traditionally been very important, and will continue to be so in the future. Today, they are the ‘price of admission’ to the competitive arena. Many competitors have reached parity on many of these important logistics attributes

and they have become standard offerings of these companies and basic requirements of customers. Organisations not meeting standards on these attributes are usually not even considered in purchasing and/or outsourcing decisions. When a firm achieves acceptable standards on these attributes, other factors become differentiators in the customer's purchase decision. One of the factors that becomes more important in these situations is reverse logistics (Stock, 2004; 42).

For the majority of supply chain members, product returns are the most significant aspect of reverse logistics. The types of items that come back and require reverse logistics processing may include product returns, product recalls, end-of-lease equipment, old/obsolete items being replaced, packaging materials and myriad other items (Stock, 1998; 73).

Traditional delivery-oriented logistics systems often don't provide comparable quality on returns. There's good reason for this: reverse logistics flow is very different from forward flow of product. A reverse logistics flow is much more reactive, with much less visibility. Firms generally do not initiate reverse logistics activity as a result of planning and decision making on the part of the firm, but in response to actions by consumers or downstream channel members (Tibben-Lembke & Rogers 2002).

Researchers in marketing and management have long debated the advantages of industry pioneers or first movers compared to subsequent entrants into the industry (Golder and Tellis 1993; Lambkin 1988; Lieberman and Montgomery 1998). Firms that develop reverse logistics programs relatively late compared to their competitors are at a disadvantage. The relative timing of a formal reverse logistics program influence the program's performance in the positive way. In such instances, the focus would be on the development of a formal program as contrasted to a non-standard case-by-case approach to handling returns.

Some researchers have found that timing and program performance are influenced by resource allocations. Deployment of differential resources results in differences in performance for new programs (Cho, Kim, and Rhee 1998). This is based on the premise that resources can be used to develop capabilities. If this is indeed true, firms should be able to leverage reverse logistics resource commitment to yield positive results regardless

of the timing (early/late) of reverse program involvement relative to competitors. Even late entrants may be able to catch up or surpass industry participants provided they allocate sufficient resources (Cho, Kim, and Rhee 1998; D'Aveni 1994).

1.4.1. Definition of Reverse Logistics

The Council of Logistics Management published the first known definition of Reverse Logistics in the early nineties as;

“...the term often used to refer to the role of logistics in recycling, waste disposal, and management of hazardous materials; a broader perspective includes all relating to logistics activities carried out in source reduction, recycling, substitution, reuse of materials and disposal” (Stock, 1992; 12).

This definition is quite general, as it is evident from the following experts “the role of logistics in all relating activities.” Besides that, it is originated in a waste management standpoint. In the same year Pohlen and Farris (1992; 37) define Reverse Logistics, guided by marketing principles and by giving it a direction insight, as follows: “...the movement of goods from a consumer towards a producer in a channel of distribution.”

Kopicky, Berg, Legg, Dasappa, & Maggioni, (1993; 23) defines Reverse Logistics analogously to Stock (1992; 13) but keeps, as previously introduced by Pohlen and Farris (1992; 37), the sense of direction opposed to traditional distribution flows: “Reverse Logistics is a broad term referring to the logistics management and disposing of hazardous or non-hazardous waste from packaging and products. It includes reverse distribution which causes goods and information to flow in the opposite direction of normal logistics activities.”

Also, Reverse Logistics (RL) or Reverse Distribution (RD) is defined as; the logistics management skills and activities involved in reducing, managing, and disposing of hazardous waste from packaging and products. It includes reverse distribution, which causes goods and information to flow in the opposite direction from normal logistic activities (Kroon & Vrijens, 1995; 61; Pohlen and Farris, 1992; 38). The Council of Logistics

Management has published a comprehensive review of concepts, organizations, and activities in the area of reverse logistics (Kopicky et al, 1993; 46).

In addition to his first definition Stock has defined Reverse logistics as "... the term most often used to refer to the role of logistics in product returns, source reduction, recycling, materials substitution, reuse of materials, waste disposal, and refurbishing, repair and remanufacturing" (Stock, 1998; 57).

In the end of the nineties, the term Reverse Logistics stressing the goal and the processes of logistics involving was described as;

"The process of planning, implementing, and controlling the efficient, cost-effective flow of raw materials, in-process inventory, finished goods, and related information from the point of consumption to the point of origin for the purpose of recapturing value or proper disposal" (Rogers & Tibben-Lembke, 1999; 82).

After the foundation of The Reverse Logistics Executive Council (RLEC) which is a collaboration of manufacturers, retailers and academics. They have defined Reverse Logistics as follows:

Reverse logistics is the process of moving goods from their typical final destination to another point, for the purpose of capturing value otherwise unavailable, or for the proper disposal of the products (Rupnow, 2002a; 5).

Also, The European Working Group on Reverse Logistics puts forward the following definition (De Brito & Dekker, 2003; 64).

The process of planning, implementing and controlling flows of raw materials, in process inventory, and finished goods, from a manufacturing, distribution or use point, to a point of recovery or point of proper disposal. This perspective on Reverse Logistics keeps the essence of the definition as put forward by Rogers and Tibben-Lembke (1999: 81), which is logistics. In the very basic formation Reverse Logistics process is illustrated at figure 1.5.

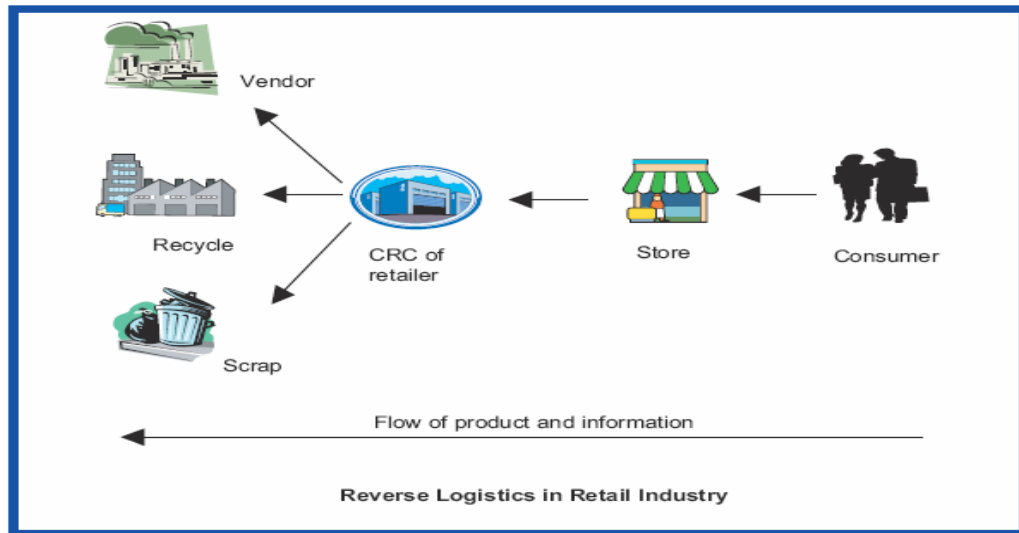


Figure 1.5.: A Simple RL process model.

Source: Daga, Ashish. (2005). Collaboration in Reverse Logistics. *White Paper, Wipro Technologies*:8. Mountain View, CA, USA.

Reverse logistics activities include; processing returned merchandise for reasons such as damage, seasonal, restock, salvage, recall, or excess inventory, recycling packaging materials and reusing containers, reconditioning, remanufacturing and refurbishing products, obsolete equipment disposition, hazardous material programs and asset recovery (Rupnow, 2002a: 7).

1.4.2. Brief History of RL and Scope

In this review I try to focus on contributions for the construction of reverse logistics theory. Since there are no established references on Reverse Logistics theory, I sometimes had difficulty not to depart from literature of Reverse Logistics.

In the literature dealing with reverse logistics one can essentially find quantitative modelling, case studies and theory building. For a review on the quantitative modelling Fleischmann, Dekker, Ruwaard, Laan, Nunen, & Wassenhove (1997), for a compilation of reverse logistics case studies De Brito, Dekker (2003) and Flapper, Nunen & Wassenhove (2004) are suggested. In addition, for more overviews on reverse logistics, the following references are suggested: Stock (1992); Kopicky, (1993); Kostecki (1998); Stock

(1998); Rogers and Tibben-Lembke, (1999); Guide and van Wassenhove (2003). Under the light of these references, findings are followed:

Though the conception of Reverse Logistics dates from long time ago the denomination of the term is difficult to trace with precision. Terms like “Reverse Channels” or “Reverse Flow” already appear in the scientific literature of the seventies, but consistently related with recycling (Guiltinan & Nwokoye, 1974; 36; Ginter & Starling, 1978; 76). The Council of Logistics Management, as mentioned before, published the first known definition of Reverse Logistics in the early nineties.

1.4.3. Review of Literature on Theoretical Developments

In the mid nineties, Thierry, Salomon, van Nunen & Wassenhove, (1995; 120) shaped product recovery management by detailly going over the recovery options, distinguishing: direct re-use (and re-sale); product recovery management (repair; refurbishing; remanufacturing; cannibalization; recycling); and, waste management (incineration and land filling). The authors characterize the recovery options according to the level of disassembly, and the quality required as well as the resulting product.

Besides these, Fleischmann et al. (1997; 12) have actually touched upon the perspectives, except for the characterization of the return reasons. The following characteristics are used to show the diversity of reverse logistics systems: motivation (economical and ecological); the type of items (spare parts, packages, and consumer goods; the form of reuse (reused directly, repair, recycling, and remanufacturing) and, processes (collection, testing, sorting, transportation).

Moreover to these studies; both academic researchers and industrial practitioners have also increasing attention towards reverse logistics during the last decade. As mentioned before, serious and persistent environmental concerns and government regulations have created a motivation to pursue further research in this field. During the early nineties, the Council of Logistics Management published two studies on reverse logistics. First, Stock (1992; 15) proposed the application of reverse logistics in business and society in general. One year later, Kopicki et al. (1993; 24) elaborated the opportunities

on reusing and recycling. In the late nineties, several other studies on reverse logistics were completed.

Kostecki (1998; 52) discussed marketing aspects of reuse and issues involving the extension of product life cycle (PLC). Stock (1998; 88) investigated how to start and carry out reverse logistics programs. Rogers and Tibben-Lembke (1999; 84) demonstrated a collection of reverse logistics business practices using a comprehensive questionnaire among US industries.

Dowlatshahi (2000; 146) brought another view to this concept. According to his aspect; Reverse logistics studies can be divided into five categories as follows: global concepts of reverse logistics, quantitative models, logistics (distribution, warehousing, and transportation), company profiles, and applications. Recently, many researchers have concentrated on the optimization and quantitative models in reverse logistics. Most of the proposed models are similar to traditional facility location models, and are in the shape of a mixed integer linear program for a single period of time (Kroon and Vrijens, 1995; 59; Ammons, Realff, & Newton, 1997; 117; Spengler, Puchert, Penkuhn, & Rentz, 1997; 314; Barros, Dekker, & Scholten, 1998; 207; Marin and Pelegrin, 1998; 388; Jayaraman, Patterson, & Rolland, 1999; 17; Krikke, Koo, & Schuur, 1999; 71; Fleischmann, Beullens, Ruwaard, & Wassenhove, 2001; 162). Other researchers studied problems with a single inbound commodity except for Spengler et al. (1997; 315) and Jayaraman et al. (1999; 18). Louwers, Kip, Peters, Souren, & Flapper, (1999; 9) proposed the design of a recycling network for carpet waste. The goal of their study was to determine the locations and capacities of the regional recovery centers to minimize investment, processing, and transportation costs. They developed a nonlinear model and solved it optimally with standard software. A comprehensive review on various cases can be found in De Brito et al. (2002; 84).

Besides, Reverse Logistics is defined as; the logistics management skills and activities involved in reducing, managing, and disposing of hazardous waste from packaging and products (Kroon and Vrijens, 1995; 62, Pohlen and Farris, 1992; 41).

It should be noticed that the first part of the above definition sounds quite environmentally oriented, which is indicative of the origins of the reverse logistics field. This

field is considered to have begun in Europe during the '70s and '80s with environmental concerns. Locklear (2001; 27) But I was able to find little work addressing the environmental costs of material exchange networks.

Saleem (2001; 144) reported cost estimates for three manufacturing scenarios in the Heating Ventilation and Air Conditioning (HVAC) industry. In the first scenario, costs were calculated for HVAC production using virgin materials. In the second one, costs for production using materials from secondary mining (recycling) processes were estimated, which reflected an 82% cost reduction compared to the first alternative. In the third approach, materials acquired from disassembly of value extracted HVAC units were used, which resulted in 88% cost savings as compared to the use of material from primary extraction.

Corbett and Kleindrofer (2001; 36) used a input-output (IO) model to evaluate the environmental impact on the entire economy resulting from the production processes. In addition, his model considers environmental impacts. He generated a substantial data set linking releases of criteria pollutants and greenhouse gases with manufacturing activities in each industrial sector. The total air pollution releases found for each commodity were combined with a range of environmental damage valuation studies to estimate the external costs of these activities.

Much of what has been published on reverse logistics has to do with reusing and recycling products and shipping materials. However, the motivation for paying attention to reverse logistics can be purely economic. For example, well before anyone had coined the phrase "reverse logistics" Henry Ford was dismantling the wooden cases from car batteries and reusing the pieces as floorboards in his early automobiles. Henry Ford probably was not an early environmentalist. It simply made good economic sense and just happens to conform to today's "reduce, reuse, and recycle" mantra. The point is that improving reverse logistics processes can have a variety of motivations and can pay off in a variety of ways.

1.5. Activities, Elements and Realities of RL

For many companies, the exercise of managing returns is not too high on their list of priorities. The fact is that in most companies, executives would rather spend their energies getting products out the door to customers who want them.

Even if they're interested, companies face complex issues if they decide to move ahead with a reverse logistics program. For one, dealing effectively with returns can prove to be more expensive than it looks, and companies with slim retail profit margins may feel they have too little to gain. Another issue is that many logistics systems aren't well prepared to deal with the reverse logistics process, even if they do a good job with forward logistics management. And accounting for reverse logistics losses isn't a simple matter, making the problem easy to ignore at budget time (Rogers, Lambert, Croxton and Garcia-Dastugue, 2002; 5).

Still, industry watchers have argued for years that it's time for manufacturers and retailers to step up and do a better job with the reverse logistics process. After all, there's a lot of money at stake. According to one estimate, \$100 billion in goods are returned each year across all channels. This costs industry channel participants about \$35 billion, according to the Reverse Logistics Executive Council (Rogers, Lambert, Croxton and Garcia-Dastugue, 2001; 5).

So, it is time to rethink about Returns. Reverse logistics is an excellent strategic source of value added revenues. Manufacturers, distributors and retailers are struggling with the reverse supply chain. Product returns handling is an important process of the supply chain that is not well handled. Economic pressures for corporate profits are forcing manufacturers and retailers to look very hard at cost controls. Reverse logistics is one of the few remaining opportunities that has not yet received much attention.

1.5.1. Reasons for Focusing on Reverse Logistics

According to Daga (2005; 7) and Rakesh, & Vinayak, (2005; 2) following are a few forceful reasons to focus on reverse logistics are listed:

1) Returns as a Competitive Advantage:

Retailing has become competitive, so every opportunity should be taken for bottom-line improvements. Returns have the potential to be one of the greatest untapped sources for increased revenue and customer loyalty.

2) Returns: Not Just a Necessary Cost of Doing Business:

Returns have traditionally been considered just a necessary cost of business. However, the costs associated with returns are far from trivial when all of the hard and soft costs are calculated to determine true business impact.

3) The Traditional Liquidation of Returns Channels Are Slow, Inefficient and Costly:

Recovering value from returns is a difficult task through the traditional liquidation channels. Although these channels are widely used, they lack ease and efficiency, and the end result for merchants is the recovery of a mere 10 to 20 percent of cost. Products lose value at every step to final disposition.

4. Returns Contain a Wealth of Information on Products and Merchandising.

Returns offer an immense amount of information about consumers and products that few retailers and merchants capture. For example, returns can provide information about the original merchandising, actual product performance, ease of use, product defects and consumer expectations.

5. Return Rates are Higher Than Ever.

Return rates are high and climbing, especially for online businesses which are experiencing increased return rates as a result of trial and impulse Internet purchasing. Calls and traffic to customer service also increases as online buyers, in particular, expect fast credits and refunds.

6. The Cost of Returning Items to Vendors is Ultimately Absorbed by Retailers.

Retailers in many industries simply return products to vendors. Sending more products back to vendor's results in necessary price increases to their customers, the distributors and retailers.

7. Third Party Logistic Providers (3PLPs) Don't Handle Returns Efficiently

Some retailers have successfully outsourced fulfillment and logistics functions to third parties for better service, lower costs and increased flexibility. However, few of these providers have yet to develop the special processes or to make the incremental investments necessary to handle returns efficiently.

8. Customer Loyalty Has Become Increasingly Rare.

Merchandise returns are a unique opportunity to engender fierce customer loyalty. Firms may use their liberal return policies as a powerful way to attract and retain their customers.

9. The Growth of Online Retailing is Undeniable and Inevitable.

Forrester Research estimates that barring unforeseen events, e-Commerce will grow to \$247.8 billion, representing 8% of total retail sales by the end of year 2007.

10. Taking Full-Advantage of New Returns Technology is the Key.

New technologies and service providers have emerged to address the increasing demand for better solutions in returns management.

11. Assets utilization (re-utilization) and Assets recovery are the means to capture the value, which otherwise will be lost. So, cost reduction and profit maximization through recycling has unignorable great importance than ever.

12. Customer Relations Management (e.g. after sales service, buy back guarantee) is increased through fulfilling the environmental obligations (e.g.: waste recycling, hazardous waste management e.g.: car batteries disposal).

1.5.2. Activities Involved in Reverse Logistics

Rakesh, & Vinayak, (2005; 3) defines four main reverse logistic processes as : Collection, Combined inspection / selection / sorting, Re-processing or Direct recovery, Redistribution.

1. Collection, refers to bringing the products from the customer to a point of recovery.

2. In the inspection / selection and sorting phase; products are being sorted according to the planned recovery option and within each option, products are sorted according to their quality state and recovery route.

3. a. Reprocessing includes:

(1) Repair : Warranty returns needs repair

(2) Refurbishing : Large installation, building or other civil object are refurbished after which it is again in a better state.

(3) Remanufacturing/Retrievals : Products are dismantled and their parts are used in the manufacturing of the same products (remanufacturing) or of different products (retrieval).

(4) Recycling : In case of recycling, products are processed in order to get the desired quality after which they are being reused e.g. paper pulp and glass.

(5) Incineration : Products are burned and the released energy is captured.

b. Direct recovery includes:

(1) Re-use : End-of-use returns often contain valuable components which can be re-used.

(2) Re-sale : Supply chain returns (products in good condition) can be sold at a discount rate or at a secondary market.

(3) Redistribution : is the process of bringing the recovered goods to the new users (Rakesh & Vinayak, 2005).

1.5.3. Application Areas of RL

Following are the industries where reverse logistics plays an important role listed by Chopra and Meindl (2003; 2) :

1. Publication houses (40-50% by volume) : To take back the unsold volumes for reuse.

2. Beverage industries: To collect and reuse the empty bottles eg Coca Cola & Pepsi.

3. Heavy industries : To collect and reuse the waste materials.

4. Consumer goods industry: To fulfill the commitments of after sale service and buy back guarantee.

5. Pharmaceutical industries: To collect the expired formulations and drugs for environment friendly disposal.

6. Automobile industries: To fulfill the commitments of after sale service and buy back guarantee.

1.5.3.1. The Storage and Disposal Processes of Ammunition

Among these application areas there is a special and very fragile area where reverse logistics has a great and variable usage. This very special material is ammunition and the sector is Defense Industry. Following are given some detailed information about the scale of surplus ammunition stocks, problems of safe disposal and destruction of ammunition, international norms and technical guidance, disposal options of ammunition, international cooperation in ammunition support programmes, developing international priorities and recommendations are mentioned.

The term ammunition which is an integral part of small arms and light weapons (SALW) includes: cartridges (rounds) for small arms; shells and missiles for light weapons; anti-personnel and anti-tank hand grenades; landmines; portable containers for single-action anti-aircraft and anti-tank systems; and associated explosives (UN, 1999, 111).

However, the key issues and challenges associated with safe, secure management and disposal of ammunition are much the same for a much wider range of types of conventional ammunition, including ammunition for heavier conventional arms such as tanks, heavy mortars, heavy artillery and other systems with more than 100 mm calibre. Even if international policy-makers find it necessary to distinguish carefully between SALW ammunition and other ammunition, in practice they are generally under the same national authorities and are often stored together.

1.5.3.2. The Scale of Surplus Ammunition Stocks

Stocks of thousands of tonnes of ammunition that are well beyond their shelf life are quite common globally. The sheer scale of ammunition stocks means that in many countries the resources and institutions required for safe management, secure storage and responsible disposal are not available. The vast overall size of global stocks of ammunition is not widely appreciated. For example, some 1.2 billion rounds of small calibre ammunition are reportedly produced annually for the US Army at the Lake City Army Ammunition Plant (Missouri) alone. Losses from individual official storage depots can amount to 100,000 rounds or more, and police

seizures of illicit arms regularly amount to thousands or tens of thousands of rounds (Pezard, 2005).

The shelf life of ammunition depends on types and storage conditions, but on average is around 20 years. After that, the ammunition becomes increasingly unreliable, and in some cases unstable. Virtually all countries have accumulated large stocks of ammunition over the years, and in many countries the scale is enormous. Stocks of hundreds or thousands of tonnes of ammunition that is well beyond its shelf life are not uncommon.

There is little reliable information about the size of SALW ammunition or other conventional ammunition stockpiles. Ammunition production and stocks are generally classified as secret for national security or commercial reasons. But information about ammunition stocks can raise greater sensitivity in armed forces, since it may relate to sustainability of military operations.

Over the past decade stocks of surplus ammunition in many countries have increased dramatically as a result of a reduction in the size of the armed forces. For example, the USA and its NATO allies maintain enormous stocks of ammunition, and have had to manage and dispose of millions of tonnes of surplus stocks since the end of the Cold War. However, in general these North American and European countries maintain relatively high standards of stockpile management and security, and have established industrial scale capacity for the safe destruction of their surplus stocks of ammunition. This is not the case in many other regions. Such ammunition stockpiling is of particular concern across much of other regions, including Africa, Latin America, South Asia, Central Asia, and East and South-East Europe.

There are, for example, huge quantities of excess munitions remaining from the end of the Cold War, mainly in the countries of the former Soviet Union. In Russia 140 million rounds of small arms ammunition are reportedly designated for disposal in 2002-2005, with stocks in excess of 100,000 tonnes of ammunition in Kaliningrad Oblast alone (Pyaduchkin and Pukhov, 2004; 109).

The Central Asian states, where the Soviet Union located a number of ammunition production and other strategic industries, inherited large quantities of arms and ammunition. Similarly, in Ukraine estimates suggest that up to 2.5 million tonnes of ammunition may be stored in Ukrainian depots that were designed to store far less than that amount, leaving a significant proportion in exposed and unstable conditions in inappropriately equipped storage facilities. The government of Belarus has declared to the Organisation for Security and Cooperation in Europe (OSCE) that some 97,000 tonnes of conventional ammunition needs to be disposed of, while Ukraine, Kazakhstan and Uzbekistan have approached NATO for assistance in disposing of some 130,000, 36,000 and 54,000 tonnes respectively. Similarly Albania, Bosnia and Herzegovina and Bulgaria are estimated to have ammunition stockpiles of 180,000, 67,000 and 153,000 tonnes respectively, of which over half is identified as surplus (Marchuk, 2004).

In Afghanistan, large stocks of ammunition were more important than guns in sustaining fighting over its prolonged period of war, resulting in what appears to be one of the world's largest stockpiles of ammunition. Further to an initial survey, efforts are now underway under the auspices of the recently launched UN-backed Afghanistan New Beginnings Programme (ANBP) to collect more than 100,000 tonnes of ammunition at identified sites, which will initially be separated out into good material which can be used by the Afghan army from the reportedly large fraction that is dangerous and unstable (UN, 2003; 75).

Similar illustrations could be found from most other regions. The sheer scale of ammunition stocks, and particularly of surplus ammunition, means not only that in many countries the resources and institutions required for safe management, secure storage and responsible disposal are not available, but also that inadequacies in these areas can result in major problems for international and human security.

1.5.3.3. Problems of Safe Disposal and Destruction of Ammunition

It is important to promote destruction and safe disposal of excessive, surplus, insecure or unsafe ammunition stocks. By permanently disposing of such ammunition, destruction programmes can make important contributions to:

- 1) Preventing and reducing proliferation and illicit trafficking of SALW;
- 2) Public safety and confidence;
- 3) Security and development at all levels – human, community, state, regional and international.

Since the issue is very sensitive, disposal of weapons and ammunition stockpiles should be evaluated as a single task area, which is not as this level yet. However, safe and effective disposal and destruction of ammunition is a much more challenging technical task than it is for weapons systems - like logistics (forward) and reverse logistics terms. The presence of explosives, toxic materials or propellants means that disposal or destruction of ammunition are relatively hazardous, and require much more detailed technical and expert response.

1.5.3.4. International Norms and Technical Guidance

OSCE has probably gone the furthest amongst regional organisations in directly addressing ammunition issues, and particularly the safe storage and destruction of ammunition. The OSCE Handbook of Best Practice Guides (2004) includes detailed guidelines relating to ammunition disposal (OSCE, 2004). Moreover, recognition at the 2002 OSCE Ministerial Meeting in Porto of the need to deal with the risks arising from stockpiles of surplus ammunition and explosives was followed up in November 2003 with the adoption of the OSCE Document on Stockpiles of Conventional Ammunition (OSCE, 2003; 32). The latter document outlines, in detail, commitments relating to surplus assessment, stockpile management and security,

transparency about needs and assistance, and procedures for assistance from other OSCE participating states in the storage and destruction of ammunition.

The potential role of those states in a position to do so to assist others in their efforts to destroy surplus ammunition is similarly incorporated into the UN framework, and the European Union (EU), under the Joint Action, is also committed to provide financial and technical assistance as appropriate to programmes and projects for countries requesting support for controlling or eliminating surplus small arms and their ammunition (UN, 1999; 112).

The physical destruction of ammunition and explosives is a highly specialist task that can only be efficiently and effectively undertaken by appropriately trained and qualified personnel and detailed guidance on the practicalities involved is to be found in a number of documents and guides. The UN Mine Action Service has developed International Mine Action Standards (IMAS) that cover the destruction of stockpiles of anti-personnel mines, but these standards are generic in outlook and can be effectively applied to cover the stockpile destruction of most ammunition natures (UNDP, 2004; 47). The aim is not to provide template solutions, but to inform national authorities of the technical and logistics issues involved in stockpile destruction and to outline advantages and disadvantages of the various available options.

The 2000 Report of the UN Secretary General on Methods of Destruction of Small Arms, Light Weapons, Ammunition and Explosives, in addition to discussing methods of destruction, also addresses the safe handling, transport and storage of ammunition and explosives (UN Document, 2000; 55).

Subsequently, the UN Department for Disarmament Affairs (DDA) Destruction Handbook: Small Arms, Light Weapons, Ammunition and Explosives are designed to assist planners in the field to choose methods of destruction that are most appropriate to the theatre of operations that they find themselves in. In addition, the OSCE Best Practice Guide on National Procedures for

Stockpile Management and Security provides detailed strategic guidance on the physical security of ammunition stocks (OSCE, 2004). Similarly the South Eastern Clearing House for the Control of Small Arms and Light Weapons (SEESAC) has developed Regional Micro-Disarmament Standards and Guidelines (RMDS/G) for South East Europe, which are in fact applicable in every region. These documents mean that national governments and international organisations now have both strategic guidelines and operational procedures available to assist them in the development of safe, efficient and effective secure management and destruction programmes.

1.5.3.5. Disposal Options of Ammunition

The principles and practices for high standards of management, security and disposal of ammunition stocks are widely agreed amongst the relatively small community of technical experts around the world. Some regional standards are widely acknowledged to represent best international practice such as NATO standards and the regional guidelines such as those established in the OSCE, SADC and by SEESAC are probably technically uncontroversial amongst expert practitioners in all regions.

In relation to disposal of SALW ammunition and other conventional ammunition, there are several well established methods: sale or gift; increased use in training; deep sea dumping, or stockpile destruction. However, as emphasised by the UN Programme of Action to Prevent Combat and Eradicate the Illicit Trade in Small Arms and Light Weapons in All Its Aspects (PoA) and in other international and regional agreements, the preferred and most effective option is the physical destruction of ammunition and explosives in terms of cost effectiveness, security and public confidence.

1) Sale or Gift

The sale or gifting of ammunition is the most cost-effective means of disposal, but there are factors that need to be considered. Any sale

or gift should comply with international export control and transfer best practices. Any end user wishing to acquire second-hand ammunition that is perhaps degraded or coming to end of its shelf life should be subject to the deepest scrutiny as to why they wish to purchase such ammunition and what safeguards they have to prevent diversion or misuse. Moreover, in order to comply with international transport regulations and guidelines the ammunition should be physically inspected to ensure that it is safe to export or transfer beyond national borders. This will mean additional costs. In general, this option is undesirable and should be discouraged. In effect, it just transfers the problem to somewhere else, where the risks may be at least as great.

2) Increased Use At Training

This can be a desirable option, but care needs to be taken to ensure that any significant increase in training does not undermine security and confidence amongst neighbouring states. Moreover, only limited stocks can be disposed of in this manner, in view of the costs of training, and time taken. When the ammunition is used it will create additional wear on equipment such as gun barrels, vehicle automotive systems etc. This will inevitably reduce the life of the parent equipment and will result in additional maintenance costs. Therefore these additional costs should be balanced against the value of the training obtained from firing surplus ammunition stocks. It is thus unrealistic as a means of destroying a substantial proportion of a large surplus stockpile.

3) Deep Sea Dumping

The dumping of ammunition and explosives at sea is subject to international agreements as it is considered to be either hazardous or industrial waste (OSPAR, 1998; 31).

Even where these do not apply, it remains important to ensure that environmental risks are low. In some countries or regions, public concern, and environmental pressure groups, make this potentially a politically costly option even where technical studies indicate low environmental impact. Moreover, these

factors reduce the prospects of receiving international donor assistance to dispose of surplus ammunition and explosives in this manner.

4) Stockpile Destruction

The preferred and often most realistic and cost-effective, disposal method is that of destruction. Stockpile destruction can be defined as the process of final conversion of ammunition explosives into an inert state that can no longer function as designed (NAMSA, 2000; 21).

Effective management of stockpile destruction planning and operational activities aims to physically destroy ammunition and explosives in a safe, cost-effective and efficient manner.

The physical destruction techniques available range from the relatively simple open burning (OB) and open detonation (OD) techniques to highly sophisticated industrial processes. The most appropriate destruction technique will depend primarily on: the resources available; the physical condition of the stockpile; the quantity of ammunition and explosives in terms of economies of scale; national capacities; and national explosive safety and environmental legislation (SEESAC, 2004; 33). Of these, the most influential factors have usually proven to be donor resources available and the economies of scale. In general, the greater the amounts of ammunition to be destroyed, the larger are the economies of scale and therefore the wider range of affordable and efficient technologies.

Moreover, for large scale or on-going destruction programmes, it becomes more efficient to develop an industrial demilitarisation facility for the purpose. This requires time and substantial resources, including donor resources for many developing countries. This sort of facility requires infrastructure investment, staff training and demilitarisation equipment procurement. Meanwhile destruction can proceed on a smaller scale, to destroy particularly insecure or potentially unstable stocks as quickly as possible.

1.5.3.6. International Cooperation in Ammunition Support Programmes

In practice the vulnerability or lack of technical expertise and resources in many countries, imply that major international assistance programmes are required to address the problems.

The UN Secretary General reported in 1999 that the UN, with donor assistance, had supported a number of post-conflict activities, including the safe storage, disposal and destruction of weapons, but as experience in Albania, Central America and elsewhere shows, the number remains small compared to apparent requirements (OSCE, 2003; 41). Despite growing political awareness of the issue, to date the international response has been limited in terms of financial support to surplus ammunition and explosive stockpile destruction as a global issue. Even there has been some progress in much of the world, a huge disparity continues between needs and response.

Few projects or priorities have so far been developed that have primarily been justified in terms of public safety, human security or development. Additionally, in some commercial cases, ammunition has been selected purely for ease of destruction or the potential return on material recovery.

The most extensive engagements at the operational level have probably been through the NATO PfP Trust Fund and the United Nations Development Programme (UNDP) Small Arms Demobilization Unit (SADU) mentioned at table 1.2. The other two major international programmes have taken place in Europe through the Stability Pact and OSCE, primarily at the political level (OSCE, 2001; 62).

Table : 1.2.: Most Extensive Engagements of the Operational Level

NATO PfP Trust Fund 	UNDP Thematic Trust Fund 
NATO's PfP Trust Fund was established to support the Ottawa Convention process in September 2000 to assist Partnership for Peace (PfP) countries with the safe destruction of their anti-personnel landmines (APM). While the original focus was to provide financial support and technical assistance purely for the safe destruction of APMs, it was agreed to extend the scope to include the destruction of small arms, light weapons and stockpiled munitions. The Trust Fund is a mechanism to partner potential donors and beneficiary countries for specific projects. It is administered by the Financial Controller at NATO HQ, and donations are made to it for specific projects approved by the NATO Political-Military Steering Committee.	The UNDP Thematic trust Fund for Crisis Prevention and Recovery is administered by the UNDP Bureau for Crisis Prevention and Recovery. It covers seven service lines, of which the two for Mine Action and Small Arms Demobilisation are reliant for anti-personnel mine or ammunition destruction. Financial resources are allocated by donors directly to UNDP, some with thematic or geographical caveats attached, and the resources are then allocated to appropriate projects to support UNDP activities in the relevant area. This enables a flexible and timely response to evolving issues, and provides a degree of stability to ongoing projects, which are not as dependant on annual donor funding cycles.

Source: NAMSA; The Executive Arm Of The NATO (2007) Eriřim: 18 July 2007 at <http://www.nato.int/structur/AC/135/main/links/namsa-e.htm>.

A range of specific assistance programmes have nevertheless been developed and/or implemented. Not surprisingly, donors have a tendency to provide assistance to those states located within their own geographic region. States reports under the PoA indicate that, of those countries giving assistance toward weapons collection and destruction generally, European donor countries report giving support primarily in South-Eastern Europe, while Association of Southeast Asian Nations (ASEAN) and Oceania countries are providing assistance in countries geographically closer to them (Kytömäki and Wayne, 2004; 111). This trend is generally born out in the activities of various regional organisations and bilateral actors outlined below. However, there are several exceptions to this. For example, the USA reports providing assistance to destroy over 44 million rounds of ammunition in a range

of countries including: Albania, Angola, Bulgaria, Serbia and Montenegro, Guinea, Lesotho, Mozambique, the Philippines, Romania and Senegal, with other projects under development.

In the seven years since it was established, a number of assistance programmes aimed at destroying stockpiled landmines and munitions have been carried out under the NATO PfP Trust Fund. Others are in the pipeline.

The first of these aimed to assist Albania in the destruction of its stockpile of 1.6 million anti-personnel landmines (APL). The project also aimed to help establish the infrastructure required to undertake industrial-scale demilitarisation of Albania's huge stockpiles of surplus munitions. This was to be achieved through training and the development of procedures, facilities and equipment. In December 2002 Canada helped to launch a further initiative to destroy ammunition in Albania. At the 1999 Summit of OSCE Heads of State or Government in Istanbul, a fund was created for alleviating the consequences of the withdrawal of the Soviet bases from Georgia. The United Kingdom, Germany, The Netherlands and Turkey were the first to contribute to the fund, which was used to implement a project for the neutralization of 400 tons of melange (a highly explosive component of missile fuel) in western Georgia (OSCE, 2007). Building on the successful completion of the Albanian project, on 1 October 2002 Georgia signed a memorandum with NATO opening the way for a joint project under which the safe disposal of missile stockpiles is assisted. The cost of the project is estimated at EUR 0.8 million with financial support provided by Luxembourg, the lead nation for the project, and other NATO and partner countries including Canada, Denmark, Netherlands, Norway, Sweden, Turkey and United Kingdom. In July 2006, the Mission signed an agreement with a specialist supplier for the purchase of equipment to smelt TNT from artillery shells and bombs (OSCE, 2007). A project for the elimination of 700 tonnes of surplus munitions and rocket fuel has also been completed in Moldova. In Ukraine, further to a programme for the destruction of a substantial proportion of the country's more than 7 million APL, a second PfP Trust Fund project to destroy 130,000 tonnes of conventional munitions is also under initial development, although not yet funded.

A number of operations involving the destruction of ammunition have taken place in South-Eastern Europe, sponsored by donors including NATO, SEESAC and the Stability Pact. In Serbia, for example, significant technical and financial support has been provided for the physical destruction of weapons and ammunition. In 2001, the role of NATO's Task Force Harvest Mission in Macedonia included the collection and destruction of ammunition. Ammunition was destroyed in May 2003 in Serbia and Montenegro and further support, in the form of training and equipment has been provided to both the Serbian and Montenegrin Interior Ministry technical personnel in order to improve the efficiency of future ammunition destruction problems. Bosnia and Herzegovina has also received assistance under the Stabilisation Force in Bosnia and Herzegovina SFOR's operation Armadillo for the destruction of the large quantities of unserviceable and obsolete ammunition. Training of soldiers to dispose of their own ammunition was an element of this operation. A UNDP/SEESAC project in Bulgaria has also seen the destruction of surplus ammunition.

While the OSCE involvement in addressing the risks of ammunition management stockpiles has to date been mainly of a standard-setting nature, under the Document on Stockpiles of Conventional Ammunition it has also received and is responding to requests for assistance from Ukraine (December 2003), Belarus (March 2004) and the Russian Federation concerning Kaliningrad Oblast (May 2004). At the request of the Government of Tajikistan, a group of OSCE experts have also conducted a study focusing on SALW and ammunition no longer in use that constitute a great risk for security with a view to ensuring their safe and secure storage and destruction. The OSCE Mission in Georgia has been carrying out a project to recycle and destroy ammunition and bombs on former military bases. Since 1999, the Moldova Mission has also been managing a project for the coordination of assistance in the withdrawal or destruction of Russian arms and ammunition from the Transdnistria region, involving the removal so far of 21,000 tonnes of ammunition.

The EU has also addressed stockpile management and destruction largely in terms of commonly coordinated assistance to third countries. While several SALW projects have been co-financed by the EU in various parts of the

world, including for example the EU small arms programme in Cambodia (which included a range of programmes relating to stockpile management and destruction), the EU has to date declared only one ammunition destruction project. In 2001, combined EU and Canadian co-operation with the Government of Albania led to an initiative to destroy excess stocks of ammunition. NAMSA implements this ongoing project.

Several ammunition destruction projects have been conducted in sub-Saharan Africa through: UNDP Country Office projects; Operation Rachel cache destruction programmes lead by South Africa; and also in Mali, Sierra Leone, Liberia and other post-conflict DDR and SALW weapons collection programmes. In Latin America and the Caribbean, some co-operation between organisations in the region, as well as with other regional and international organisations, has taken place. For example, in late 2003, the Government of the Republic of Paraguay carried out the destruction of 15 tonnes of ammunition and explosives that had been stockpiled in the government's War Material Directorate. The destruction was carried out with the support of numerous organisations and with the cooperation of a number of government departments – including the Ministries of Foreign Affairs, Defence and Education. UNDP has also been active elsewhere in the region, where tens of thousands of rounds of ammunition have been destroyed in Argentina, Brazil, Haiti, and Honduras.

In the Asia-Pacific region, Australia and New Zealand have both contributed to improving the storage and management of armouries, to help address the problem of leakage of weapons and ammunition from stockpiles. The Australian Defence Force, for example, has provided assistance to Pacific Island Countries in strengthening armoury security, including training in stockpile management practices and advice how to improve the physical security of a number of armouries. For example, in the Solomon Islands where there were no proper measures in place for the storage and management of ammunition and explosives, the Australia-funded Law and Justice programme has reportedly resulted in significant progress in terms of accounting procedures, physical security and destruction of munitions (Kytömäki and Wayne, 2004; 130).

1.5.3.7. Developing International Priorities and Recommendations

About this sensitive issue; the international community needs urgently to prioritise action to promote safe and secure management and destruction of SALW and other conventional ammunition stocks. The following measures are needed:

1) Develop specific global norms: In contrast to some other aspects of the global agenda for SALW, there is wide informal agreement amongst technically-expert practitioners across the world on international best practices and guidelines relating to safe and secure management and disposal of SALW and other conventional ammunition. Specific international norms and standards on these issues need to be officially developed, and adopted at global level.

2) Identifying Priorities: While best international standards and practices need to be encouraged and adopted where possible, the scale and urgency of the problem means that priorities need to be set. Programmes are needed to tackle the most vulnerable stocks: either by urgently enhancing the safety and security of stocks to avoid completely intolerable risks by destroying such stocks. Thus international professional understandings of emergency minimum standards and of prioritisation criteria are also needed.

3) Developing an adequate international assistance programme: Measures are needed to develop a much larger and more coordinated international action programme in this area. In contrast to the present efforts, this needs to be widely supported, well-resourced, more institutionalised, and have mechanisms for information exchange, coordination, and emergency action.

4) International Information Exchange: Lack of official information relating to ammunition stocks has hampered efforts to tackle the problems. Specific national, regional and international mechanisms for information exchange are required to address this problem. Further research is also required.

1.5.4. Elements of Reverse Logistics

Daga (2005; 4) determined the necessary elements as follows:

1. Gate keeping : Gate keeping has been defined as “the screening of defective and unwarranted returned merchandise at the entry point into the reverse logistics process.”

2. Compacting Disposition Cycle Time : Disposition cycle time is the amount of time needed to figure out what to do with returned products once they arrive. Often, when material often comes back in to a distribution center, it is not clear whether the items are; defective, can be reused or refurbished, or need to be sent to a landfill.

3. Reverse Logistics Information Systems : With the emphasis being given on reverse logistics today, the IT system developed to handle reverse logistics should be flexible enough for inevitable future expansion, as well as to have the ability to handle the many exceptions involved in reverse logistics. The reverse logistics system should create a database and track returns at the store level back through the pipeline to the manufacturer.

4. Centralized Return Centers (CRCs) : CRC's are dedicated specialized buildings to handle returns. All of the company's customers send their returns to such a central location where the items are subsequently sorted, processed, and dispositioned. This system is essential for orderly and organized method of handling returns.

5. Zero Returns : Zero Returns is a program where the company in question does not accept returns from its customer. Rather, it gives the retailer an allowable return rate, and proposes guidelines as to the proper disposition of the items. This strategy basically passes the returns responsibility onto the retailer, while reducing costs for the manufacturer or distributor.

6. Asset Recovery : Asset recovery is the classification and disposition of returned goods as surplus, obsolete, scrap, waste and excess material products, and

other assets, in a way that maximizes returns to the owner, while minimizing costs and liabilities associated with the dispositions.

7. Outsourcing : Many companies have established reverse logistics systems and procedures. In many cases, however, it makes more sense for the firm to outsource their reverse logistics functions than keep those in-house.

1.5.5. Realities of Reverse Logistics

Whether strategies/programmes are developed for a supply chain or its individual members, there are several important truths regarding reverse logistics that have significant implications for costs, revenues and customer service. There are many that could be listed, but some of the more important ones are identified as follows, along with some of their general implications (Stock, 2002; 47).

1. The most successful reverse logistics solutions merge efficient forward and reverse flows into one process. Implications are that, in much the same way as companies realised significant customer service and financial benefits through the integration of inbound and outbound distribution activities, the combination of forward and reverse logistics together result in benefits. Equipment, facilities and personnel can share both forward and reverse logistics activities, resulting in synergy in terms of reduced costs and improved service levels.

2. Reverse logistics programmes should be developed primarily for uncontrollable returns and not all returns, which also include controllable returns (for example, wrong product or quantity shipped, out-of-date products, damaged products). The implications are that, sometimes, firms develop systems and programmes for all returns, even those that could be eliminated through improvements in product quality, better on-time delivery performance, or a reduction in shipping errors. Optimal reverse logistics programmes should be developed only for those uncontrollable returns.

3. Shorter product life-cycles require a faster return on investment (ROI) from all systems and processes of a company or supply chain, including the reverse logistics process – for example, personal computers have a marketing life of 26 weeks,

semiconductors nine months (Robert, 2001a; 47). The implications are that products with short product life-cycles lose their value more quickly. Thus, any delays in forward or reverse logistics that keep the items in the distribution system longer than necessary will result in some loss in product value. As products move into the mature or decline phases of their product life-cycles, prices tend to decline, causing margins to shrink.

4. When communication gaps or misinformation occurs, physical product tends to fill in the gaps (Robert, 2001a; 47). The implications here are that, historically, safety or buffer stocks are typically larger in companies or supply chains when inefficiencies exist within or between firms. For example, lack of information about customer demand requires additional products to cover for the uncertainty in demand. Lack of data on when transportation carriers will make pick-ups/deliveries requires that shippers/consignees hold more safety stock to cover for transport uncertainty. Generally, uncertainties usually result in excessive safety stocks as a means for protecting the firm or supply chain.

5. Most distribution facilities were not designed to handle reverse product flows, nor are personnel trained to effectively or efficiently decide whether to resshelf, repair, discard or return items to vendors/suppliers (Robert, 2001b; 45). The implications are that, often, when touring warehouse facilities or retail backrooms, product returns are usually just 'sitting around' rather than being handled and stored with the same diligence as products moving in a forward direction. Pallets of returns do not resemble the neat and efficient stacks of new merchandise being shipped to customers. Usually, returns are placed in a more haphazard fashion on pallets and shrink-wrapped to maintain their integrity. Products being returned may not be in the same boxes in which they were shipped, so the use of bar-code reading devices may not be appropriate. Each item must be checked individually to determine its specific identity.

6. Good product quality and efficient logistics programmes on the forward side invariably reduce the number of returns on the reverse side (Dubbs, 2001; 35). The implications here are that 'the best return is no return'. Product returns that can be eliminated before they become returns dispense with unnecessary time and costs needed to handle, store and dispose of them. The most highly efficient and

effective forward logistics programmes have fewer product returns as a percentage of total revenues or sales. Optimal reverse logistics programmes are developed only for those returned products that need them (Stock, 2002; 48).

1.5.6. Complications of RL

Two University of Nevada professors, a few years ago, asked more than a hundred large companies why they didn't have a strong reverse logistics program. Nearly 40% said that returns management simply didn't seem as important as other issues. Technology was also a problem: 34.3% of supply chain executives said they didn't have the right systems in place. More than a third said that company policies stood in the way (Brannon, 2006; 34).

Given the low importance placed on returns management, it hasn't always gotten its share of IT dollars. While a growing body of software has emerged to manage returns, in most cases the reverse logistics process is managed largely on paper. As a result, in some cases, supply chain managers hardly know what they'll find on their loading dock (Brannon, 2006; 34).

Such confusion leads to long lapses between product arrival and product disposition. In fact, the average company takes between 30 and 70 days to get a returned product back into the market, including return transportation, repair or refurbishing, and redistribution to the customer or market, according to Boston-based analyst firm The Aberdeen Group (Wright, 2006; 53).

While it's expensive to process the returns using a paper-based, uncoordinated system with few controls, the cost doesn't always show up in ways a company would immediately recognize, what happens is that reverse costs often exist in several different budgets, they'll show up in other places that aren't normally associated with the return, including equipment usage, shipping costs, handling and labor costs (Tibben-Lembke, 2004; 97).

It should be admitted that reverse logistics management isn't for everyone. Admittedly, in some situations, it's hard to make these operations pay.

Reverse logistics, at its core, was formed to address the issues of products returned to manufacturers by customers. To date, the industry's focus has been handling the return of large items in very small quantities or small items in relatively larger quantities (Brannon, 2006; 38). If companies don't have the volume, it can be extremely inefficient. The cost of reverse logistics per unit is typically more due to manual handling and dispositioning strategies. And because the quantities are small, as opposed to large shipments common on the outbound, there's a higher cost.

In some cases, however, turning returns into revenue is a critical part of the business. In fact, in industries where returned merchandise represents a substantial volume of the business such as book publishing, catalog firms and consumer electronics makers returns management can be important to overall company profitability (Sorenson, 2002; 59).

PC manufacturers, for example, have a great deal to lose if return rates are high. Right now, the average profit from a PC sold in the U.S. is about \$76, but the combined cost of technical support and returns is about \$95, according to data from the Ease Of Use/PC Quality Roundtable (Sorenson, 2002; 59), a group of PC and peripheral suppliers and software organizations.

In other industries, the sheer volume of returns cries out for attention. For example, book publishers see 20% to 30% return rates, according to estimates by RLEC. Catalog retailers experience rates as high as 35%. And greeting card companies regularly are faced with rates between 20% and 30%, RLEC has found (Rogers, Lambert, Croxton and Garcia-Dastugue, 2002; 5).

1.5.7. Size of RL in USA

Lastly, I would like to introduce some statistical data about RL and its portion in USA business and economy. A conservative estimate is that reverse logistics accounts for a significant portion of U.S. logistics costs. Logistics costs are estimated to account for approximately 10.7 percent of the U.S. economy. However, the exact amount of reverse logistics activity is difficult to determine because most companies do not know how large these are.

As mentioned above in the “PC” and “Book” industries examples; reverse logistics costs should be taken seriously into consideration. Reverse logistics costs accounted for approximately 4 percent of their total logistics costs. Applying this mean percentage to Gross Domestic Product (GDP) , reverse logistics costs are estimated to be approximately a half percent of the total U.S. GDP. This would account to approximately ($\$11,667.515 \text{ Billions} \times 0.5\%$) \$ 58,34 Billion in 2004 in the U.S. alone (Caldwell, 2004; 11).

Since reverse logistics is an important emerging issue Rupnow (2002; 3) explains that companies and industry associations in USA are developing groups and panels to address key reverse logistics topics for example;

1. Joint Unsaleables Management Conference by the Grocery Manufacturers of America, Food Distributors International and the Food Marketing Institute.

2. Unauthorized Deductions Management (Matching Returns to Retailer Claims) Session at the National Candy Association (NCA) State of the Industry Conference.

3. Panel Discussion - "Taming the \$10 Billion Beast: Reducing the Costs of Taking Back Product" at the Consumer Electronics Association (Fail Conference 2002).

4. 'Managing Returns in a High Return Industry' and 'Warehousing's Role in Reverse Logistics' at the Warehousing Education and Research Council (WERC) Conference 2002.

So we can conclude as; possible options for reclaimed product are; refurbish (improve product beyond original specification), recondition (return product to original specification), salvage (separate components for reuse), repair (prepare for sale as a used product), sell to 3rd Party, recycle, discard/liquidation (landfill) and main key incentives for reverse logistics are; customer retention/satisfaction, container reuse, recycling programs (transport packaging), damaged material returns, asset recovery/restock, downstream excess inventory (seasonality), hazardous material programs, obsolete equipment disposition, recalls (Moore, 2005; 7).

SECTION 2

REVERSE LOGISTICS STRATEGIES

In this section some of RL strategies, their application areas and the possible results that can be gained after the executions of them is explained.

2.1. Collaboration in Reverse Logistics for Competitiveness

Nowadays many businesses have now realized that a reverse logistics system can be used to gain competitive advantage. Even the best retailers and vendors now have reason to review how their returns programs are managed. In today's business world new technologies and service providers offer an opportunity to improve overall returns management. This means not only reducing the cost of returns, but utilizing returns to improve customer loyalty, merchandising and product performance. Improving returns management process can transform an increasingly costly and complex process into a competitive advantage. It has forced businesses to reengineer their business processes and look into what can be the next practices in business rather than adopt best practices.

Efficient reverse logistics system can be used as an opportunity to reengineer the business processes to get a better picture of the future practices. As described before, reverse logistics is a very complex and specialized area of any supply chain and it involves handling individual incoming parcels, opening and inspecting products, communicating with internal departments, customers and vendors and then directing products into disposition channels which will provide the highest value (Tibben-Lembke, 1998; 42). It is necessary to have a synchronized effort from all the supply chain partners for reverse logistics to be successful.

Returns require special information systems, dedicated equipment and personnel trained in non-standard processes. To create visibility in the returns supply chain a firm requires greater information sharing and using automated notification to support integrated decision making (Daga, 2005; 3). So, collaboration between all supply chain partners is imperative and this collaboration is the key to establish the smooth flow of products and information in reverse logistics.

In this collaboration process; visibility can be achieved through tracking products which is in turn enabled by technology. UPC barcodes have been in existence for time immemorial now to track the flow of products in the forward supply chain. However, with the limited ability of barcoding, reverse logistics becomes difficult to manage. Hence, the emergence of new technologies like 2D barcoding which enables storage of much larger amount of data on the barcode and also RFID (Radio Frequency Identification) does provide a way ahead to effectively manage returns. Technology like 2D barcoding and RFID will act as an enabler in achieving collaboration in reverse logistics. Without the common vision behind the need for collaboration none of the elements in the reverse supply chain can achieve the competitive advantage offered by reverse logistics (Daga, 2005; 3).

2.1.1. Supply Chain Collaboration

Daga (2005; 5) defines that; collaboration is a concept, an operational philosophy, and a set of principles to guide the enterprises' relationships with its partners. Technology enables collaboration; today's business needs mandate that a business collaborates with its partners if it is to survive.

Simply defined supply chain collaboration is any kind of joint, coordinated effort between two parties in a supply chain to achieve a common goal. Supply chain collaboration in general provides ability to integrate information, enables monitoring of events in the supply chain, provides visibility across the supply chain, allows to manage processes by taking corrective action. In this process the following facts defined by (Tibben-Lembke, 1998; 45) should be taken into consideration. These fact are:

1) The total cost of returns is high: The total costs associated with returns are significant. These costs are cross-functional and hit numerous expense lines, cost centers and budgets. As a result, retailers and manufacturers have difficulty measuring all of the hidden costs or fully understanding the business impact.

With some effort; the hard costs can be measured. These include warehouse staff, customer service associates, shipping, storage and inventory space, third party vendors, packaging for disposition, disposal fees and other direct costs. Higher prices from

suppliers for accepting returns can also be identified. The soft costs, such as customer satisfaction and loyalty, are much more difficult to measure but can have a major impact nonetheless. For the importance of customer concern Tanyeri and Tavmerger, (2004; 13) underlines that; in the future, value-added activities will be leaded by the customer and it seems that the movement for all the logistics operations will be towards being truly customized for each customer which may be called one-to-one marketing though it seems imposible to apply right now due to high cost associated. Retailers also believe that the total cost of returns could be as much as 5-10% of sales.

2) Value recovery from returns has traditionally been low: There are a number of established methods for recapturing some value from returned merchandise. In-store sales and return-to-stock are labor intensive, provide mixed results and also pose risks to brand equity and cannibalized sales. Traditional liquidation channels have provided low value recovery; often only 10% - 20% of retail value due to slow and inefficient paths back to consumers. The Internet has enabled new channels for selected merchandise that offer more direct, faster resale paths with higher recovery.

3) Return-to-vendor adds significant and unnecessary cost: Retailers in many industries simply send returned products back to vendor/distributors for credit. Devaluation of product as it moves backward slowly in the supply chain is dramatic. Handling, storage and shrinkage costs mount at every step of the way as the product becomes increasingly out of date. The administrative costs of managing the complex, diverse returns policies among hundreds, or even thousands of retailers, distributors and manufacturers is another major cost of return-to-vendor programs. In an effort to reclaim some of these costs, leading retailers are now negotiating attractive “no returns” pricing with their suppliers in exchange for taking over all returns, including warranty and repairs.

4) Merchants going online are finding returns a challenge: With this boom in online retailing has come some chaos in all areas of customer service and fulfillment, particularly with returns. According to data from a number of industry research firms, return rates for online sales are substantially higher than traditional retailing. Rates of 20% to beyond 30% for certain categories have been reported. Most fulfillment centers, information systems and customer service centers designed for handling traditional retail simply cannot efficiently process this volume of returned merchandise. As a result, returns

costs are high and returning credit to consumers has often been slow. This poor performance is a barrier to new or repeat sales to time-focused buyers.

2.1.2. Opportunities for Collaboration in RL

In this operational philosophy area there are some opportunity areas and these certain areas are listed by Daga, (2005; 8) as below;

1) Gatekeeping (Warranty): One significant area of conflict between a retailer and vendor is the warranty of returned products. Retailers are expected not to accept products returned to them beyond the warranty period. However, there are difficulties in screening defective and unwarranted products at the store level. Store level clerks and front line personnel are often unwilling or unable to gatekeep the returns process, due to the absence of adequate information at the point of return. Moreover, once a product is accepted at the store level from the customer the decision is generally not overturned.

The first steps towards collaboration need to be taken while dealing with warranty at the customer-retailer interface. Any product with a lapsed warranty should not be allowed into the reverse supply chain by retailers; such products consume time and effort in the reverse supply chain. If the product enters the supply chain it needs to be dispositioned – recycled, refurbished or returned deciding the appropriate course of action is a potential area of conflict at the retailer-vendor interface. Verification of products at the store level may be done using invoices or serial number of product. However, this is easier said than done because tracking of millions of individual items requires maintaining a large database which proves inefficient, retrieval of information is time consuming and not cost effective.

After the customer-retailer interface, the next stage for collaboration comes at the retailer-vendor interface. Once the product is accepted by the store it is moved to the customer return center (CRC) of the retailer which is simply illustrated at figure 2.1. There generally is some time gap between these two events. This delay may be due to a minimum return quantity stipulated by the retailer to stores or specified time periods during which returns are accepted. For any product accepted close to the end of warranty, its warranty may expire during this time delay. Hence, information systems at the CRC should

be responsive and raise exceptions and alerts to warn the retailer and expedite the returns process. The system should check if demand for this product exists elsewhere in the network of stores and accordingly arrange for movement of stocks.

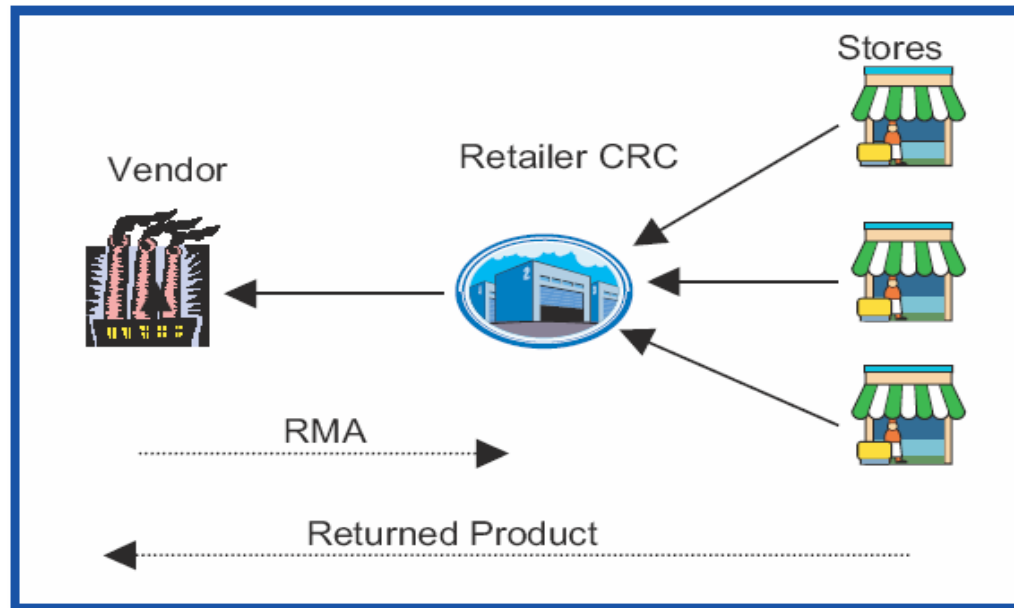


Figure: 2.1. Return Material Authorization from the vendor.

Source: Daga, Ashish. (2005). Collaboration in Reverse Logistics. *White Paper, Wipro Technologies*:8. Mountain View, CA, USA.

Another scenario for the expiry of warranty arises when a product awaits a Return Material Authorization (RMA) from the vendor at the CRC. The time delay between the product arriving at the CRC and being shipped to the respective vendor could be very high, due to delays in processing of the RMA, during which the warranty of products may expire. In order to reduce this delay the return process should allow raising RMA's at intervals depending on the product in question rather than a fixed time interval or awaiting an economic shipping quantity. For example; for products with a low shelf life RMA processing should be more frequent such that the product does not exhaust its shelf life in the return process.

About the RMA issue, Daga (2005; 9) reminds that; RMAs could be raised depending on near expiry items and independent of quantity of product being returned. This becomes especially important in industries such as pharmaceutical and

agricultural products. In case agricultural products return, it must involve accepting a product as early as possible so that it may be moved to locations where it is required in the near future rather than await an RMA for an inordinate period during which it may be rendered useless for the entire season.

The expiry of the warranty of a product after its return to the store, at any point in the supply chain raises issues of ownership leading to friction between various supply chain partners, especially between vendor and retailer. To resolve these issues amicably it is extremely important that the supply chain partners collaborate to reduce the overall return logistics cost and thereby reduce cost incurred by individual partners.

2D barcoding is a cost effective technology which if implemented will prove helpful in warranty tracking since it enables the availability of such critical information about the product like its description, serial number, date of manufacture, end date of warranty, price, shipping details etc. This enables the tracking of individual products even if it were produced in millions. Thereby, quick decisions regarding movement of products across the supply chain may be taken and reduce the losses due to out of warranty products.

2) Return Material Authorization: A return material authorization is a request sent to the vendor by retailers on a regular basis from the Corporate CRC for the approval or returning products to the vendor. For this request to be approved and individual RMA's sent to the regional CRC's may take a considerable amount of time. Thereby, causing delay in disposition of returned products, delays in transfer of saleable products to other potential markets and occupying valuable space at return centers.

As mentioned above RMA's are prepared on a regular basis, the periodicity being defined by the vendor. Generally, the rule could be to request for an RMA only after a certain minimum number of products being returned, to attain efficiencies in transportation. Alternatively it could be to request for an RMA only after a fixed interval in time. Both these rules are damaging to the flow of products in reverse logistics.

Collaboration would be required between vendors and retailers to ensure the flow of products in reverse logistics. It is important that they understand specifics

of the return supply chain and agree on disposition of returned products. To ensure this collaboration information on daily returns needs to be available centrally to both the retailer and vendor so that they may optimize the frequency and cost of transportation.

3) Return Price Rationalization: It is common knowledge that the price of a product varies over its life cycle. This change in price occurs at irregular intervals and the price may rise or fall depending on the product. This continuous change in price poses a challenge in financial reconciliation when products are returned.

Daga (2005; 10) mentions that; for any product in the retail chain two prices come into play. First, the price paid by the retailer to the vendor and second, the price a customer pays to buy the product.

a) Customer-Retailer interface: On returning a product, customers demand a reimbursement from the retailer. The retailer is hence obliged to pay the customer at the price at which the product was bought. However, customers may have misplaced or lost the invoice making it impossible to verify the price for reimbursement. Two cases emerge from this scenario:

(1) Reduction in price of product after it was first purchased. Owing to lack of information customers are reimbursed at the reduced price, they suffer a loss. This leads to loss of face of the retailer and a loss in customer loyalty and brand image of the retailer.

(2) Reduction in price of product after it was first purchased. In this case the retailer is at a loss since he has to reimburse the customer at a higher price. The retailer hence suffers a financial loss on the return in question.

Hence, it is important to be able to track the price of individual products while being returned by customers. Serial number tracking could be the answer to resolve this issue.

b) Retailer-vendor interface: Daga (2005; 10) also tells that; once the product is in the reverse supply chain and the retailer needs to return the product

to the vendor an important question arises about the price that should be reimbursed to the retailer by the vendor.

Since the price of the product would have changed frequently over the period between its flow in the forward supply chain and the reverse flow the challenge lies in tracking this price at every stage in the supply chain. To gauge the complexity of this problem; a lot of a single product returned from the CRC to the vendor can be imagined, this single lot will contain items of different batch numbers or manufacturing date, hence could have different prices. The challenge lies in getting price visibility of every single item in this returned lot.

The price visibility is extremely significant due to the financial impact it has on the respective supply chain partners. Vendors and retailers should work on a returns policy which does not force either of them to take a hit on losses due to change in price, this returns policy at the same time needs to be framed keeping the end customer in mind else it could threaten customer retention.

4) Handling Product Returns: The normal return path of a product is its movement from the customer back to the vendor through a retailer. However, in certain instances customers resort to returning products directly to vendors. As illustrated below at Figure:2.2.

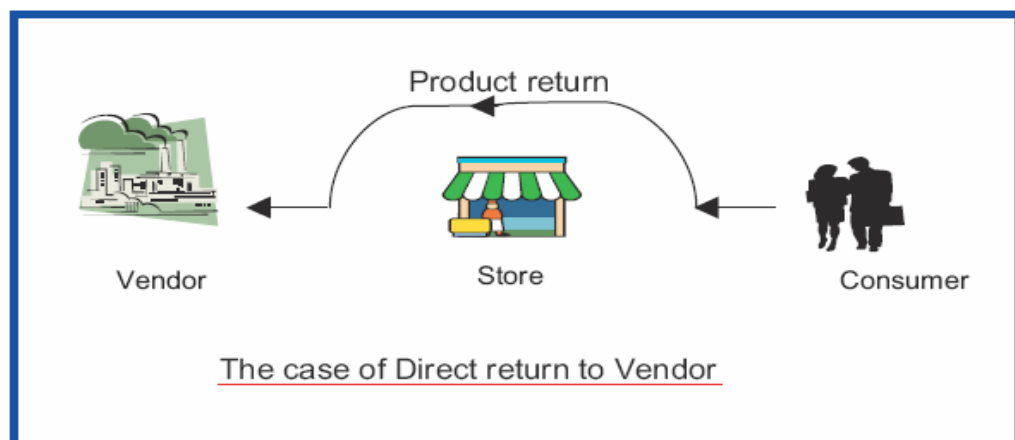


Figure: 2.2. The case of Direct return to Vendor.

Source: Daga, Ashish. (2005). Collaboration in Reverse Logistics. *White Paper, Wipro Technologies*:8. Mountain View, CA, USA.

This leads to a unique interface in the reverse supply chain, the customer-vendor interface. This interface warrants the vendor to be in a position to handle the return directly and reimburse the customer as per the price paid by him to the retailer. Customers expect reimbursement for the product returns almost immediately. They do not expect to wait endlessly for the confirmation on product returns between the retailer and vendor. Hence vendors should have adequate information on products being returned in this fashion so as to respond to customers directly. The impact of this direct and timely response is increased customer service, customer loyalty and improved customer retention.

To expedite reimbursements for a returned product vendors need to have information regarding the product/item in question. Details like from which retailer the product was purchased, what was the price of purchase, serial number of the item etc. Serial number information in such a situation is important since it is the piece of information which links the item returned to the retailer to whom the product was sold as well as the customer who purchased it. The link can be established from the point-of-sale information.

5) Product Returns with Damaged Packaging: Most of the time products returned by customers to retailers or vendors are not in the original package. Either the package in which the product is returned is damaged or is of a different product all together. Daga (2005; 11) underlines that; this creates problems in reverse logistics since any identification put on the product is lost and products are not in a position to be identified by any scanning media leading to a discontinuity in information flow in the supply chain. Again, Daga (2005; 11) details it in two interfaces as;

(a) At the retailer-customer interface: Retailers may refuse to accept products not returned in the original packaging, this leads to friction between customers and retailers which ultimately results in an irate customer thereby affecting customer satisfaction, retention and loyalty and diminishing the brand equity of the retailer.

(b) At the retailer-vendor interface: Products with no means of identification are as good as lost in the supply chain. Retailers should form a strict policy on returns of this kind since the financial liability in accepting such returns falls on them initially, thereby affecting cash flows. Vendors at the same time should resort to using technology that enables tracking of products in the supply chain even if the original packing is lost or

destroyed. RFID is one technology which enables tracking of products since the RF tags are placed on the product directly and not on the package.

2.2. Growth Strategy and Source-Reduction Strategy as Part of a RL

An opportunity to generate additional revenue, differentiate market position, and support original product demand is sitting right in front of many companies. Rogers, Lambert, Croxton and Garcia-Dastugue (2002; 5) quotes that; reverse logistics costs account for almost % 1 of the total United States Gross Domestic Product (GDP). Therefore, reverse logistics is rapidly becoming an integral component of retailers' and manufacturers' profitability and competitive position.

Product returns are the most common aspect of reverse logistics. About this common aspect Banker (2001) tells that; most companies do not handle returns well not because they are part of their core competencies

As a result, many companies are working closely with 3PL providers, while others are still considering the best way to handle reverse logistics. A primary reason for this is the massive shift in revenue opportunity that now follows each product sale. McCluskey, Bijesse, Sodano (2002; 27) explains that; customers will spend 5 to 20 times the initial sales price on subsequent services and consumables.

This leaves some companies seriously considering a "closed loop" approach to the supply chain that includes product returns, service contract returns, product recalls, used equipment and replacement parts for refurbishment, as well as reuse or sale as raw material.

Increasingly, reverse logistics must be considered part of a successful growth strategy. Banker (2001) explains that; today, having a solid disposition logic is an essential aspect of an asset-recovery strategy. Returns, repairs, and used items can also have branding implications. For some companies, brand protection is paramount, and they want to ensure their goods are not sold in secondary markets and do not end up being sold in discount stores.

It is important that a company control the availability of its products even in the secondary market. Reverse logistics can be used as a differentiator to distinguish one company from another, which further increases switching costs to competitors. A well-defined reverse logistics growth program can also be used to capture customer opinions and needs that can deepen the collaborative relationship.

While many companies have begun to recognize the need to address reverse logistics, few have strategically examined the opportunity or established explicit contribution objectives and formal processes for asset refurbishment, resale or disposal (McCluskey, Bijesse, Sodano, 2002; 27). In a recent survey of 125 product manufacturing firms, one research firm estimated that 50-70 percent of companies' total potential revenue from the average product lifecycle is unserved.

2.2.1. RL as a Source-Reduction Strategy

As the generating revenue in the growth strategy, within this evolving environment, many leading businesses now also realize that a reverse logistics system, combined with source-reduction processes, can be used to gain competitive advantage. As they take responsibility for post-consumer waste, they are striving to generate revenue or achieve cost savings, or at a minimum, keep from losing money from regulatory compliance.

Source-reduction strategies can dramatically affect the environment while reducing costs and improving customer satisfaction. In pursuing source-reduction strategies, any company is able to generate consumer goodwill, reduce overall costs, and stay ahead of government regulations. In fact, the real business leaders can actually influence the legislation. According to Kopicki and Legg (1993; 132); source-reduction strategies continues to surface as the most promising alternative for minimizing wastes and environmental effects while gaining possible competitive advantages. The basic source-reduction principles entail:

1. Making things smaller and lighter, thus resulting in lower logistics costs.
2. Minimizing production and distribution operations, to reduce the amount of waste materials generated.
3. Reusing materials and containers more than once.

4. Substituting materials that are environmentally friendlier.

Kopicki and Legg (1993; 132) also adds that these source-reduction strategies can increase end user satisfaction while reducing costs and wastes. Examples include Johnson Controls' initiative to make batteries that are just as powerful as—yet only half the size of—the products they replace. Similarly, Sears' packaging reduction program, which cut the amount of shipping packaging in the supply chain by 1.5 million tons, saves the retailer approximately \$5 million annually in procurement and disposal costs.

A number of organizations are capitalizing on reverse logistics opportunities. Kopicki and Legg (1993; 132) gives the examples of companies such as Eastman Kodak (reusable cameras), Hewlett-Packard (printer toner cartridges returned for refilling), and Sears (25-percent reduction in packaging) have implemented successful reuse and recycling programs. These initiatives not only have reduced the amount of waste fed into the supply chain and the landfills, but also have lowered operating costs for these companies.

All of these organizations have begun to think of the reverse logistics process as “investment recovery” as opposed to simply minimizing the cost of waste management. Saccomano (1997; 22) mentions that; they have been able to recover their cost investments from one or more of the following areas which are: raw material and packaging procurement, manufacturing, waste disposal, and current and future regulatory compliance. Furthermore, many of the programs implemented by these leaders bring the added benefits of improved employee morale and public image.

For these companies, the benefits outweighed the costs of their reverse logistics and source-reduction programs. But, cost is a real issue. At multiple points in the typical supply chain, materials and supplies flow back up the chain or to waste sites. Saccomano (1997; 22) also tells about all of the “REs” associated with these reverse flows bring cost implications. Returns and recalls are obvious examples. But other “REs” include refusals, reworks, recyclables, rejects, reprocessed overruns, reuse, remake, redo, residues, reorder, resale, and returnable shipping containers and pallets. These “REs” can be a real operational nightmare for companies, costly to process and administer. The direct

and indirect costs of correcting them can be staggering. In some industries, such as direct catalog sales, returns alone can run as high as 20 percent of sales.

Kopicki and Legg (1993; 130) quotes that; The Council of Logistics Management in 1993 published the results of a landmark research project on reverse logistics. Even it was an early classic in this field, it identified five action areas where supply chain professionals could assume the lead role as:

1. Adapting inbound supply chains to use materials recovered from municipal waste recycling programs.
2. Creating reuse and recycling programs for packaging waste in forward distribution channels.
3. Recovering products from customers for reuse and recycling.
4. Developing third-party services to facilitate the recovery of in-plant wastes and used products.
5. Increased social concern about solid waste management is transforming the relationship between the environment and business and creating new roles for logistics professionals.

Kopicki and Legg (1993; 130) also continues that; after determining the above mentioned issues Supply Chain Professionals suggested the following strategic issues to handle these reverse logistics challenges at various points in the supply chain:

One way is to shift the responsibility by minimizing the cash flow into the capital equipment, operating systems, facilities, and people needed to support such activities. Through this “cost minimization” approach, firms spend money on their primary business and on logistics activities that directly serve customers, ignoring or shifting costs of the “REs” to customers, consumers, government, and society.

Another approach is to passively wait and be regulated into action. Companies can satisfy customer demands and government regulations by acting in a passive, “follow the rules” manner. Although this approach minimizes costs, it continues to shift the burden of waste disposal to the general public.

A more proactive alternative attempts to stimulate customer demand and reduce the cost to both the company and to society. As the automotive industry's experience has demonstrated, battery returns can be a means of reducing waste management costs, while at the same time enhancing customer satisfaction and lowering production costs. By recycling 90 percent of the lead from used batteries, manufacturers have kept demand for holding down costs to consumers.

Another proactive strategy is to reduce the amount of materials used in producing and delivering products. The computer industry has had some success by developing smaller and more powerful products. Less material is used in producing and packaging the goods; meanwhile, logistics costs drop along the supply chain. This source-reduction strategy benefits all supply chain members as well as consumers.

One more highly effective strategy is to reengineer how business is conducted. Through this "paradigm shifting" approach, firms step back and take a hard look at what values reverse logistics processes can add for consumers specifically and society in general.

Rifkin (1995; 155) gives an example for this approach is CD release in music production business. This example describes how music production companies now tap into communications systems to download new CD releases to computers in retail outlets. In these micro-production retail outlets, consumers select the new release they want. A blank CD is sourced, the recording is made, the promotional package jacket is printed in color, and the CD is assembled for sale. Logistics costs drop sharply as local, flexible micro-manufacturing costs are increased. The impact of this development on inventory costs and any close-out costs are very positive.

With the proper strategies and metrics in place, reverse logistics should be part of the larger product and customer lifecycle strategies and can serve as a foundation for establishing customer loyalties and increasing market share.

In the UPS Press Release (2004.,14) a remarkable example is given as; on April 2, 2004, the Digital Product Division of Toshiba America Information Systems, Inc. and UPS announced a new laptop computer repair process designed to reduce turnaround time

for customers to four days or less. The move is part of a wide-ranging customer service initiative by Toshiba designed to raise the bar in the highly competitive PC market. Toshiba expects to build customer loyalty, improve customer satisfaction, and save millions of dollars by streamlining its service operations and gaining better inventory visibility.

Banker (2001; 41) also mentions that; "As of 2003, annual global service parts logistics (SPL) spending was estimated to be \$21 billion, increasing at a rate of 7 percent per year. Post-sales service has even greater Wall Street implications. Forrester Research notes that aftermarket quality issues have a direct correlation to stock value. "The very day a manufacturer unveils a product quality issue to Wall Street, its market cap drops almost 10 percent and doesn't recover for at least three months.

Tanyeri and Tavmergen (2004; 13) also explains that quality used to be an issue overlooked by logistics firms but it is gaining the attention it deserves today. Quality management is a logistics trend that goes hand in hand with marketing activities since if a product becomes defective, if a service delivery cannot meet required conditions or if promises are not kept, no value can be added to logistics function.

2.2.2. Improving Reverse Logistics Operations

As it is often the case in complex business systems, the starting point for reverse logistics operations' improvement is not within the operational processes. It must happen well before operations and even before a product reaches production. Marketing should define; how the secondary market affects original equipment demand and also what customer experience is sought. Once these numbers are derived, McCluskey, Bijesse and Sodano (2002; 28) define that; a manufacturer can focus on the operational improvements needed to achieve these numbers.

As underlined before; an often overlooked strategic aspect of reverse logistics is that it "clears the channel" for future purchases. By working with customers to trade up to replacement or new products, companies are able to elude inefficiencies and costs by avoiding product obsolescence. This also releases capital and space for replacement products. Of course, customers may buy replacement products, but the existing products that were displaced, which are the older products anymore, could very easily find their way

into secondary markets and lessen the demand for newer products. McCluskey, Bijesse and Sodano (2002; 28) gives some examples concerning the issue in the following paragraphs.

VCR manufacturers present a good example of an industry that failed to provide reverse logistics. With the growing popularity of DVDs, any of the VCR manufacturers haven't tried to retain customer loyalty by offering a reverse logistics program for old VCRs. Opportunities for the manufacturers to gain customer loyalty by helping dispose of old technology while up-selling and/or cross-selling some of its newer products is lost. Time and again, new technologies are introduced to customers without reverse logistics strategies or market penetration goals in place.

The computer industry is another example where solid reverse logistics strategies and goals can help a company end the lifecycle of one of its old products while introducing newer technology to its customers. The key is to dispose of the old product, but keep the customer. A good reverse logistics strategy should be as much about the lifecycle of the customer, as the lifecycle of the product.

And also they attract attention to an Internet search of used computers warrants over 11,500,000 hits. One company, which disposes of used computers, processes more computer equipment in a single month than it did in an entire year just several years ago. Its expected volumes will quadruple in the next 12 months to more than 100,000 units annually or about 3 million pounds of computers.

In the UPS Press Release (2004; 32) it is mentioned as; according to the International Association of Electronic Recyclers (IAER) 2003 industry report, "There are more than 500 million units of computer equipment – CPUs, monitors, printers – currently installed in the USA from all sectors, including consumer, that will be obsolete in less than five years." IAER also cites a U.S. Environmental Protection Agency report from 2002 stating, "91 percent of consumer electronics are discarded. This recycling statistic says nothing about the generations of used computers being sold in emerging countries or secondary markets. Without providing any type of customer experience or knowing the name and contact information of the buyer/user, any opportunity to up-sell, cross-sell, or try and maintain customer loyalty is lost.

The report also continues as that; “Many companies are struggling with how to properly handle used and obsolete electronic goods and their components. They know that managing these goods within regulatory guidelines is critical to their post-sales supply chain to increase operational efficiencies and control costs, as well as contribute to a safer environment”.

An operational improvement agenda can be pursued in case the “context” of demand management and customer experience are defined. Moore (2005; 5) defines a well-executed improvement program of a growth strategy likely to have the following parts:

1) Process Definition: As paths of returns lead to varied ends as well as revenue streams, it is of paramount importance to direct return products into the appropriate stream early. As products enter inappropriate processes, inefficiencies such as corrective actions begin to arise. Not only are companies paying for removal of assets, but they also pay for activities that the contractor is performing such as sorting and redistribution of materials prior to recycling or disposal. When companies begin to redesign internal processes to manage the receipt of materials, the sorting and testing of items is performed internally before anyone outside handles them, and the contractors only gets what they are supposed to get. Typically, the cost and duration of the disposition cycle are directly related. A key element of accelerated disposition is accurately directing the returns through the appropriate process. To this point, the verification of the correct path should occur when the RMA is issued.

2) Network analysis also is critical when redesigning reverse logistics operations. The network might best be configured with multiple, strategically located centers worldwide. Each processing center should be logistically positioned to accommodate the existing transportation network, optimizing the routes of current supply trucks that might have backhaul opportunities.

3) Centralized return centers can operate much more efficiently. In fact, there are opportunities to reduce the cost of reverse logistics throughout specific lanes such as consolidating early to reduce transportation costs. Other benefits of early consolidation include understanding the complete picture of returns, and gaining economies of scale when negotiating with business partners (e.g. secondary market resellers).

4) Re-use/Salvage: Some companies refer to returned materials as “surplus assets,” including by-products, used equipment and waste streams, because they have value in the marketplace. A company can re-use virtually anything that can be recycled for internal use, amounting to significant dollars worth of material annually. Additional annual income can be generated from the sale of equipment and materials to entities outside the company. Increasing numbers of companies now capitalize on recyclers and other secondary markets to sell excess or obsolete equipment as well as byproducts of their production processes. Salvaged materials might be used as service inventory. Also, companies may be able to reduce their raw material costs through creative use of salvaged materials. And companies should continue to look for new opportunities as product lines and processes change.

5) Intangible benefits: Countless benefits can result from an effective reverse logistics program. For instance, through the use of pollution prevention, a company can coordinate and market an effort that incorporates product refurbishment, process modification, equipment redesign and reuse of waste materials to minimize the introduction of non-usable waste into the environment. Companies can reduce the generation of waste with the prioritization of waste prevention, re-use and recycling.

2.2.3. Effective Reverse Logistics Growth Program

Again, returning goods into the supply chain is equally important as moving goods to market, so assigning key executives to centralize, manage and improve the asset-recovery program is fundamental to achieving profitable results.

When developing a reverse logistics growth program, process responsibilities should be clearly defined. Moore (2005: 7) gives the details as; while a company’s logistics division may coordinate the product return operation, the production department may manage asset recovery. Therefore the production department would handle the material that has fallen out of the system prior to reaching the customers. Well documented approaches benefit both consistency and traceability, which lead to greater efficiencies .

Resource recovery and disposal on secondary markets can get complicated when the refurbished items begin competing with new items and offerings. When

comparable resource recovery products end up on the market, not only are companies competing against themselves, they also risk damage to the corporate image and unhappiness with the buyer.

As stated before revenue generating opportunities exist in reverse logistics programs, i.e. resale, recycle, etc. Returned products may even be donated for tax and public relations benefits. When these other options have been exhausted, the company may choose or be forced via regulatory purposes to dispose of returned product. When this is the case, the primary principle for businesses is to dispose adequately at minimum cost. While regulatory controls are becoming more stringent on proper disposal of products, the cost of dispensing waste continues to rise.

Moore (2005: 7) explains a high-level model of an effective reverse logistics growth program for each company defining how an effective reverse logistics growth program will affect customer experience and original equipment demand while contributing to revenue. This model consists of the following steps:

1. At the installation site, authorized personnel complete the appropriate forms and attach them to the items being funneled to the recovery operation. *(Customer, service, and logistics processes must be defined and communicated.)*

2. Supply trucks bringing new products and materials to near-by sites can backhaul the older parts and materials to the local supply location. *(Schedules, transportation, networks must be established and effectively managed.)*

3. Dedicated staging locations at all supply locations as well as at some customer locations specifically for materials bound for the processing centers. *(Customer processes and expectations must be clearly defined and communicated.)*

4. An intranet connection facilitates communications between the processing centers, supply centers and customer locations. *(Communication processes and infrastructure must be established.)*

5. A database of buyers categorized by certain classes of materials should be maintained. *(New processes must be developed to support new revenue streams.)*

6. When the trucks arrive at the processing centers, sort the material, categorize it according to buyer, then notify the appropriate buyers that the material will be placed for silent bid. Processing centers may also include company stores, where customers can shop among the items that make the journey through the processing center and are determined by site managers to have purchase appeal. *(Processing center network, operations, and organization established and managed for on-going improvement.)*

7. Each lot of material is described and placed for auction on a medium such as the company's web site. The lots generally remain up for bid for a specified time, e.g., five days *(Sales techniques and mediums must be identified as well as processes, business rules, and metrics.)*

8. The winning bidder typically gets a specified time, e.g., an additional five days to pay for and pick up the material. Buyers are responsible for transport. *(Expectations and business rules must be developed and communicated.)*

9. Track materials inbound and through the sorting, bid, sale and release processes with a central accounting system. All cash collected from sales should be sent by the buyer to a central clearinghouse, which authorizes release of the material and performs all the reporting, accounting and reconciliation activity. *(Central tracking system should be developed and analyzed.)*

2.3. Design of Reverse Logistics Network

Higher customer expectations will force service providers to be able to respond quickly and improve service levels. Even there will be some issues that will stay the same, the design of logistics firms will be a key factor and competing on cycle time, cost and quality will remain as important issues (Tanyeri and Tavmerger, 2004; 11).

In conventional supply chains, logistics network design is commonly recognized as a strategic issue of prime importance. The location of production facilities, storage concepts, and transportation strategies are major determinants of supply chain performance. Reverse logistics should also be taken into account during the design of the support network such as location and capacity of warehouses, plants, choice of outsourcing vendors, distribution channel and supporting technology. Returns information captured easily should be integrated with forward supply chain information to achieve optimum planning and reduction of costs. The whole support network can then be designed in such a way that it can service both the forward and reverse logistics processes efficiently by means of giving all key members access to the same data at the same time in order to meet the logistics firms goals (Tanyeri and Tavmerger, 2004; 18). This is in line with the concept of a closed-loop supply chain design.

Verma and Vinayak (2005; 4) categorizes the logistic network structure serving to RL into two portions:

1) The Convergent Network

This portion of the network accumulates used products from individual sources and conveys them to some recovery facility. Companies can set up dedicated returned products collection centers at specific locations or collect the products through retailers and distributors.

2) The Divergent Network

A divergent network part links recovery facilities to individual customers purchasing reusable products. This portion of the network is very much similar to traditional forward supply chain distribution networks and integration with forward supply chain can be done for maximized optimality.

Verma and Vinayak (2005; 4) defines the four strategic points that should be taken into consideration in the design of reverse supply chain network as :

1) Acquisition/collection of returned/used products

Managing the collection and acquisition of used and/or returned products potentially accounts for a significant part of the total costs of any closed-loop supply chain. To design the network for collection a company can install several drop points for customers to hand in used products, integrate the reverse flow of used products with other transportation flows or use a direct express mail system to bypass several stages of the network for fast processing. The type of design depends on different product types and needs of the customers. Retailers and distributors are often used as the points of collection.

2) Testing/grading operations

The location of the test and grade operations in the network has an important impact on the flow of goods. It is only after this stage that individual products can be assigned to an appropriate recovery option and hence to a geographical destination. It is important to see a tradeoff between transportation and investment costs at this stage. Testing collected products early in the channel may minimize total transportation distance since graded products can directly be sent to the corresponding recovery operation. On the other hand, expensive test equipment and the need for skilled labor act as drivers for centralizing the test and grade operations.

3) Reprocessing

The reprocessing generally requires high investments in establishing the network for reverse logistics. The costs for specialized remanufacturing or recycling equipment influences the economic viability of reprocessing, integration of product recovery operations with the original manufacturing process can offer economies of scale which involves sharing of locations, workforce, or even manufacturing lines.

4) Redistribution

Redistribution stage resembles a traditional distribution network. In particular, the conventional tradeoff between consolidation and responsiveness in transportation is noticeable. If collection and redistribution are combined, efficiencies in vehicle loading can be achieved. Redistribution can also be done along with distribution of new products.

Reverse Logistics Information Systems has also a very important portion as in the forward plannings of supply chains. One of the most serious problems that the companies face in execution of a reverse logistics operation is the lack of good information systems. To work well, a flexible reverse logistics information system is required. Reverse logistics is typically a boundary-spanning process between the companies or business units of the same company, thus developing systems that have to work across boundaries adds additional complexity to the problem. For a retailer, for example; a system that tracks returns at store level is desirable. The system should create a database at store level so that the retailer can begin tracking returned product and follow it all the way back through the supply chain. Information systems should also include detailed information programs about important reverse logistics measurements, such as return rates, recovery rates, and returns inventory turnover etc.

For many companies, current information systems do not allow them to monitor the status of their returns. Additionally, useful tools such as radio frequency (RF) are helpful. New innovations such as two-dimensional bar codes and radio frequency identification license plates (RFID) may soon be in use extensively.

2.4. Creating Value Through RL

In the light of increasingly strict regulatory measures, emanating particularly from Europe, that limit landfill disposal and extend producer responsibility into post consumption product life stages, firms should take in to consideration to work hard on the reverse logistics processes and look for some surprising benefits as well.

As we know, traditional supply chain management focuses on delivering value to end-customers through integrated management of various processes such as procurement, order fulfillment, demand management and customer relationship management. Unlike traditional supply chain management, reverse logistics as a process, refers to the set of activities related to getting goods (products, materials, packaging) back from point of use to points further up the supply chain where they can be reused, refurbished, resold, or disposed of properly. These activities, as defined by Rogers and Tibben-Lembke (1999; 83) include gatekeeping (managing the insertion of goods into the reverse supply chain), collecting, sorting and grading returns, developing a network of logistics providers to

transport and process returned goods, refurbishment and/or remanufacturing of selected goods, resale or reuse, and ultimately proper disposal.

Effective reverse logistics management can add significantly to a firm's profitability and ultimately, to shareholder value. As environmental legislation continues to become increasingly strict, firms can either take the minimalist approach by doing only what is legally necessary, or they can seek out opportunities presented by the environmental legislation. Contrary to conventional wisdom, environmentally responsible logistics practices can be highly profitable for firms.

The key is to take a systems approach to better understand the total costs and benefits of reverse logistics system. If firms are interested in producing a better return on assets and creating shareholder value while getting products back and pushing them up through the supply chain to be reused, sold or properly disposed of, which means creating value in any way, in the frame of keeping ahead of environmental legislation ROA approach helps. The Return on Asset (ROA) approach provides a systematic means for understanding the cost/benefit tradeoffs. To capture potential benefits, firms should shift their focus from viewing returns as an unwanted but necessary evil and instead look for opportunities to transform returns into additional revenue, profit and market capital.

Viewing reverse logistics only as a cost-minimization exercise may cause the firms to miss a real opportunity. Opportunities to recapture and create value in the supply chain should also be explored. Using a ROA approach is one way to assess value creation through the returns process. ROA is a key indicator of a firm's profitability and also a key contributor to shareholder value. Mollenkopf and Weathersby (2003; 20) tells the contribution of an effective returns management to improved ROA in several ways as follows:

First, reclaiming products/parts that can be reutilized in the forward supply chain can reduce a firm's cost of goods sold (COGS) dramatically. Even if refurbishment or remanufacturing is required, revenues can ultimately be gained from inputs where a refund is not required. Since the firm has already paid for the raw materials once, doesn't have to reprocure or totally transform them again in order to gain additional revenue.

Appliance and electronic goods manufacturers are prime examples of organizations that are taking advantage of this type of non-traditional supply. Firms that lease their products such as office equipment and computer manufacturers, also focus on asset recovery initiatives to reclaim their end-of-lease products. Many of these products (or at least their parts) still have useful life that can be offered to other customers at very little up-front cost.

Second, operating expenses can be reduced through effective and innovative returns management programs. In addition to minimizing costs relative to returns processing, customer service costs can be reduced if the return process is streamlined from a customer's perspective. Additionally, capturing information about the reasons for returns being made can be leveraged to further improve the product, thus reducing future returns. Effective returns management and processing can also reduce a firm's environmental compliance or waste disposal costs.

Third, assets in the form of obsolete inventories can be reduced if returns are managed efficiently. This means getting merchandise returns from dealers in a timely manner so that alternative uses can be made of the inventory before the only option is to write it off, and then dispose of the product. Managing the timing of returns is especially critical for seasonal or short life-cycle products. Merchandise returned at the end of a season has little potential for alternative use. Making earlier decisions about stock disposition in the field can provide many opportunities to reuse inventory before it becomes obsolete. This means implementing channel-cleaning policies with dealers and retailers to manage not only the quantity of returned products, but also the timing.

Fourth, return products are often an overlooked source of additional revenue. Recovered product may be re-sold through existing or new channels, depending on the characteristics of the target markets. For example, remanufactured computer products are often resold to consumers that represent a different target market than the original equipment manufacturer's (OEM) primary customers. Original customers might include large corporations purchasing computer equipment in large volume. Second-time around customers may be small businesses or consumers who wish to purchase a certain computing power, but are unwilling or unable to pay premium prices for new equipment. In the case of multi-use packaging such as 55-gallon drums or intermediate bulk containers

(IBCs), the COGS is essentially the collection freight and the reconditioning cost. Those reconditioned products often sell at a price point approaching new containers, and actually have a higher gross margin. Not exploring these potential new markets can really short change a firm's revenue opportunities.

Fifth, another source of additional revenue comes through better inventory management. Better inventory management and channel cleaning initiatives can help prevent markdowns, and thus help retain higher margins on sold products.

Sixth, the market positioning power of effective returns management programs should be considered also. As customers and consumers become increasingly conscious of the environmental impact of the corporations they deal with, being able to honestly promote reverse logistics activities can help a firm gain repeat business and increase customer loyalty. Many firms are finding that significant brand equity can accrue by being an environmentally responsible corporate citizen.

2.4.1. The ROA Approach

Profitability analysis is an important means of assessing logistics activities and proposed changes to a firm's logistical systems. Profitability analysis goes beyond total cost analysis by incorporating the revenue impact of logistical activities. For example, an improved level of service may bring about increased revenue as customers respond to higher levels of service. Such changes must be built into logistical system analysis. Additionally, the impact of assets such as inventory levels, accounts receivable and fixed logistical assets should be incorporated into a comprehensive profitability analysis approach. A critical measure of strategic success is Return on Investment (ROI), which can typically be measured by Return on Net Worth (RONW), or by Return on Assets (ROA). RONW measures the profitability of the funds that owners have invested in the business, and is most likely of interest to shareholders and investors. ROA provides a more operational perspective by providing a view of how well managers utilize operational assets to generate profits. Thus, Lambert and Burduloğlu (2000; 8) underlines that; ROA becomes a key managerial tool for logistics profitability analysis.

The Strategic Profit Model provides the framework for ROA analysis by incorporating revenues and expenses to generate net profit margin (NPM), as well as an inclusion of assets to measure asset turnover. They (2000; 9) also take notice that; net profit margin measures the proportion of each sales dollar that is kept as profit, while asset turnover measures the efficiency with which assets are used to generate sales. Together, they form the basis for ROA. Figure 2.3. provides the general framework for understanding how logistical decisions can impact NPM, asset turnover, and ultimately, ROA.

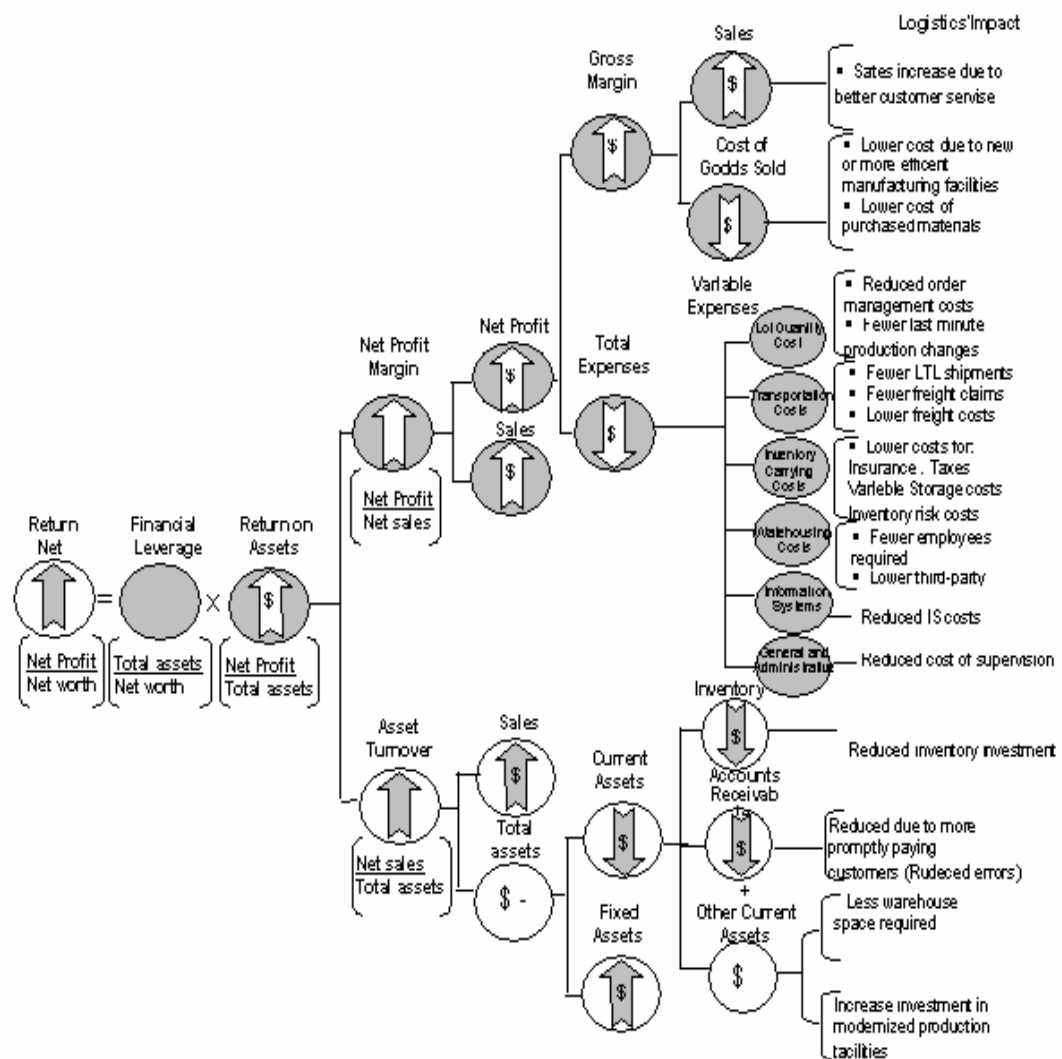


Figure: 2.3. The General Strategic Profit Model.

Source: Lambert, Douglas M. and Burdureğlu, Renan. (2000). Measuring and Selling the Value of Logistics. *The International Journal of Logistics Management*, 11(1), p:22.

In using the ROA approach they (2000; 10) explain to better understand the impact of reverse logistics decisions in figure 2.4. which illustrates that the impact of reverse logistics goes beyond cost reductions. In fact, the impact can be broadly described in terms of;

- a) Cost reductions that come through reduced cost of goods sold and operating expenses,
- b) Improved asset turnover through better inventory management, and
- c) Increased revenues in both the short and long terms through additional sales and full-price maintenance due to newer stock being offered.

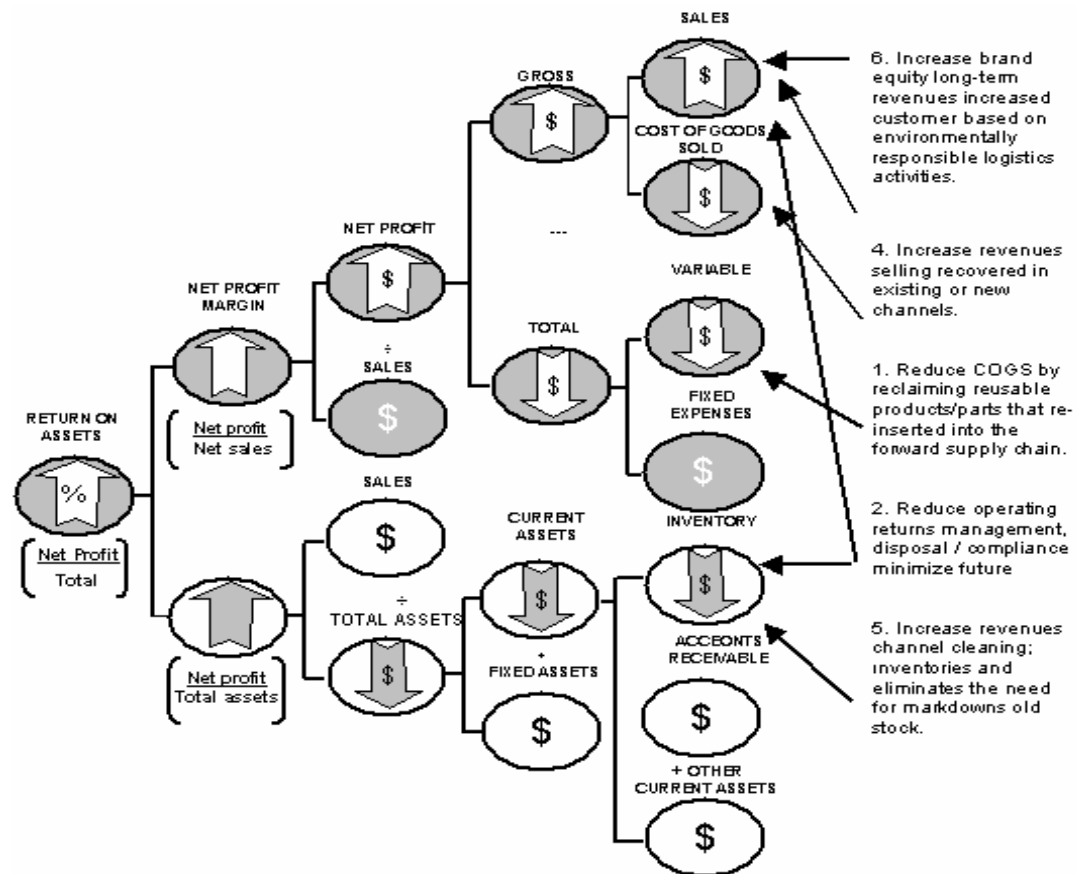


Figure: 2.4. The Impact of RL Activities on ROA.

Source: Lambert, Douglas M. and Burduroğlu, Renan. (2000). Measuring and Selling the Value of Logistics. *The International Journal of Logistics Management*, 11(1), p:23.

2.4.2. Creating Value in Returnable Packaging Area

In the returnable packaging arena, opportunities to create value can come about by switching from expendable to returnable containers. This not only avoids the disposal cost for expendable packaging, but returnable containers may be able to provide additional protection to products, thus reducing product damage, along with the related lost sales and expenses to correct the damaged product. Of course, returnable packaging may not always be cost-justifiable, so a total cost approach to analyzing the expendable versus returnable container option should always be taken. This may also involve reviewing and re-engineering packaging materials to ensure recyclable material is being used. There can be significant value added in the form of market perception, particularly in examples like the chemical industry's "Responsible Care" program where members have significant measurable commitments to "Reduce, Reuse, Recycle

On a somewhat larger scale than switching a corrugate box for a plastic tote, is the whole issue of mobile assets. These are usually more expensive types of containers, such as beer kegs that must be returned from a restaurant or pub back to the brewery (Mollenkopf and Weathersby, 2003; 24). Such containers represent a significant investment for a firm, and the movement of these assets should be carefully managed, so as to minimize shrinkage and damage to the containers, as well as to minimize cycle time as the containers rotate through the closed loop system.

Managing cycle time is especially important so as to maximize asset utilization, and minimize the total number of containers needed to keep the system running smoothly. For example; a brewery cannot afford to run out of kegs. But it's equally important that it should not underestimate the financial consequences of having too many kegs in the system. Besides brewery, the chemical railcar industry provides another example of mobile asset management. Somewhat unique in the rail industry chemical companies tend to own or lease their own railcars due to the specialized nature of the cars. Thus, railcars are essentially bulk chemical product containers that rotate through a system from factory to customer and back again. Poor management of these assets has led chemical companies to invest in more railcars than necessary while the utilization rate on each railcar remains very low, because they sit idle on rail sidings or at customer plants for far too long. At approximately US \$70,000 per car, the investment level is high, while the returns on these

investments remain unnecessarily low. Thus effective asset utilization becomes an important means of improving a firm's ROA, and ultimately its value to share-holders.

2.5. Process Reengineering to Reduce Cycle Time and Improve Customer Service Quality Through Speed in RL

Ever growing concern for environmental problems, and pressure from the global competitive marketplace toward further improvement of customer service, have been presenting industries with a new challenge which is the development and management of effective reverse logistics processes.

Interest in the field of reverse logistics is growing rapidly as many types of businesses recognize it as a vital part of the overall supply chain. So, the need for quick, flexible and effective reverse logistics is growing because of the environmental concerns and regulations. The catalyst that sparked this interest in reverse logistics has been environmentalism recently. Reverse logistics practices have often been environmentally driven, particularly in European countries such as Germany, where environmental regulations are more stringent than in the U.S. Melbin (1995; 37) mentions that more organizations are reusing and recycling items that would previously have gone into landfills. Retzlaff-Roberts (1998; 14) explains that; many organizations are discovering that improving their reverse logistics processes can be a value-added proposition that may or may not have anything to do with environmental concerns. Businesses have discovered that valuable commercial opportunities are embedded in reverse logistics.

The added value could be attributed to a rapid reaction time, improved customer service leading to increased customer retention and sales. The added value could also be through reduced cost and/or reduced cycle time. So, naturally Retzlaff-Roberts and Frolick (1997; 72) tells that; while environmentalism is and will continue to be a driver behind reverse logistics, it is by no means the only one.

Organizations are now realizing also that as Dawe (1995; 79) determines that ignoring RL is a costly oversight with a detrimental effect on customer service. About the customer service Tanyeri and Tavmerger (2004; 12) reminds that; customer service is a process for providing significant value added benefits to the logistics operations in a cost

effective way. It is clear that excellent customer service should add value for all the members of the logistics management. However, the benefits of improving reverse logistics capabilities are not just environmental. Other benefits include reducing cycle time, improving and increasing customer service and quality and also reducing costs through process reengineering and speed in RL.

2.5.1. The "Need for Speed" in RL

Mentioning about the term “speed” Tanyeri and Tavmerger, (2004; 16) defines this magic term as the ability to create a innovative and quickly moving logistics operation to customer demand. One of the best opportunities for profit in reverse logistics operations is available in the area of asset disposition. One of the best ways to enhance the disposition value of refurbished goods is through “speed”.

Many high tech companies, processing high value returns, are often letting significant profit evaporate into thin air simply by not focusing enough attention on speed. Rupnow (2001; 2) states that; there is a huge opportunity to recover significantly higher values from returned assets by paying close attention to the impact of time on the disposition value of rapidly depreciating returned goods.

Rupnow (2001; 3) defines the three possible ways to take advantage of the opportunity to recover greater value from returned goods: Assessing revenue opportunities, assessing reverse logistics process timeline and focusing on maximizing recovery value.

1) Assessing Revenue opportunities: Mainly, there are two areas to assess for capturing the value on a corporate satisfaction and speed-centric approach.

a. Customer vs. Corporate focus : Many RL operation have a customer focus. Once the customer is satisfied, issued a credit or sent a replacement product, the staff breaths a sigh of relief and moves onto the next customer return. However, at this stage, return processing is not complete and processing moves its focus away from customer satisfaction and onto corporate satisfaction to take full advantage of the opportunity to recapture the highest possible value from those returned assets.

b. Impact of Time on Value : The impact of speed, which is essential to recover the highest value, can be assessed by looking at the life cycles of each returned products and the related market value that is lost over time. In this concern Rupnow (2001; 4) gives a very sharping example about any high tech company having a line of some of the hottest products that can be found in almost any computer stores today. These hot products are changing so quickly that their life cycle on the store shelves is not much more than 3 months. That translates to about 1% per day of depreciating value as it is shown in figure 2.5. below.

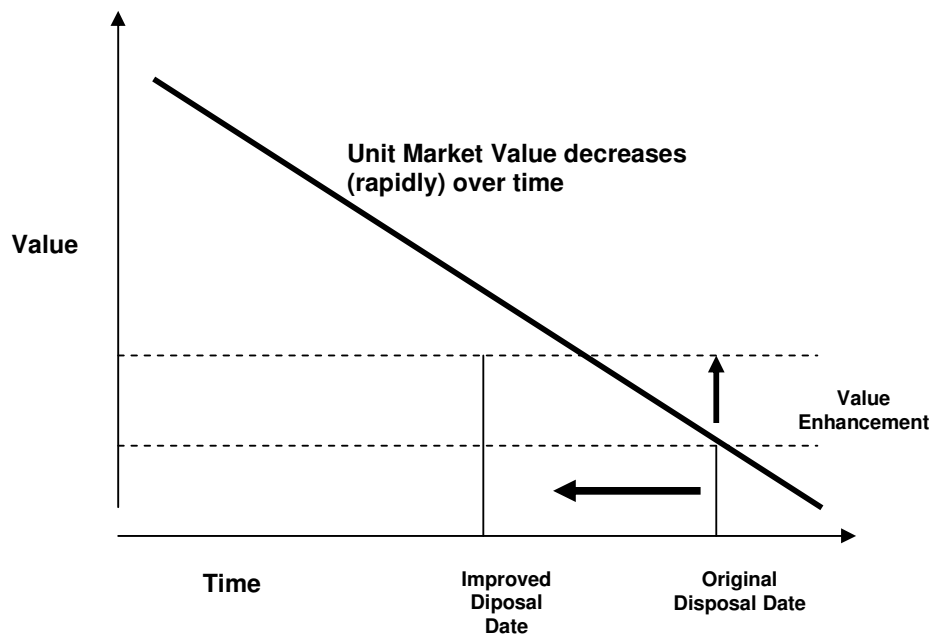


Figure: 2.5. Enhancing Recovery Value of Returned Goods

Source: Rupnow, Paul. (2001). Reverse Logistics Speed. *Reverse Logistics Professional Report*. Eriřim: 12 April 2007 <http://www.Andlor.com>.

In this concern; a short life cycle product is an excellent example of the need for speed. Depending on the last mentioned definition; if two weeks time can be chopped out of recoverable returns processing, 14% of revenue can be added to recovery value since 1% depreciation is not given up per day. If there comes 2000 refurbished units per month with an original cost of \$100, the opportunity here is \$28,000 per month is obvious (14% gained depreciation x \$100 cost x 2000 units).

Of course, product timelines may not have straight line value depreciation always, but a review of major items will provide with the appropriate curve to enhance decision making process on the profit opportunity.

2. Assessing RL Process Timeline

The "Speed" is an excellent opportunity for reverse logistics processing operations to increase revenues and profits by reducing lost value to time. A detailed review of the time a unit takes at each stage of reverse logistics process will help time saving opportunities. In recapturing the highest value for returned goods through eBay auctions, almost every company has not effectively evaluated the impact of time on their returns processing and asset recovery. Unfortunately, this is a tragedy that so much value is lost to time.

An example timeline is outlined below at figure 2.6. to help to assess improvements to timeline. While evaluating, it should be ensured that all the steps be included. For example; the unit that waits for several days on a pallet until enough units are consolidated to move that pallet to the next stage of processing. By looking carefully for opportunities to reduce time, the impact of depreciation can be reduced and higher revenues can be generated.

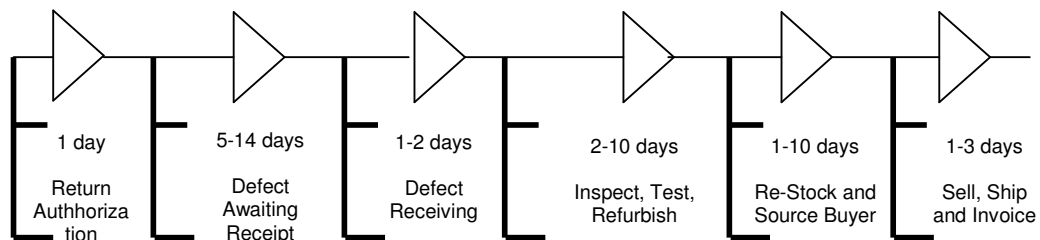


Figure: 2.6. Example Reverse Logistics Timeline

Source: Rupnow, Paul. (2001). Reverse Logistics Speed. *Reverse Logistics Professional Report*. Erişim: 12 April 2007 <http://www.Andlor.com>.

3. Focus on Maximizing Recovery Value

Reverse logistics is the process of getting the goods back to organization and recovering value from those returned goods. At an individual unit level, the item needs to be

returned from the customer, inspected and then streamed to the path that will yield the highest recovery rate for that unit. By focusing on maximizing recovery value, reverse logistics process will be driven process improvements, since speed is critical to higher recovery.

2.5.2. Reducing Cycle Time in RL

The returns process and the manner in which the necessary information is obtained varies among businesses. However, all returns begin with a customer indicating that a return is desired and end after the product has been returned to the supplier and the customer has received credit. Retail returns (in-store) are typically performed in person to person, and the customer is usually given a receipt. Such returns are fairly fast and simple because all the information is provided quickly via the receipt and verbal information. The merchandise can change hands and credit can be issued almost immediately.

Other than this person to person return process, there is another type of return which is consumer direct mail returns. This type of returns are not as fast or simple because of the need to ship the product back to the supplier, which means the customer is not available to answer questions verbally when the return is processed. This type of return is rapidly increasing due to growth in direct mail purchases. Witt (1995; 59) makes an estimation that by 2010, direct mail will account for more than 50 percent of consumer purchases. Most direct mail merchandisers include a return form, shipping label, and instructions for returns with every shipment. The return form provides the information necessary for processing the return, thus making it easier for the customer as well as the merchandiser. It is difficult for customers not to follow directions. In commercial returns, the customer typically is expected to contact the supplier to request a returned material authorization number, at which time the supplier opens a corresponding record with the relevant information.

Return policies vary by industry and supplier (Padmanabhan & Pang, 1995; 67) and depending on their type returns are often restricted to a limited time period following the purchase. This is particularly important in the computer industry where products quickly become obsolete. In addition, commercial returns often involve limits on the volume of stock balance returns. A stock balance return occurs when a customer decides too much product has been ordered, the product is unused, and is resalable.

I will try to explain how a cycle time reduced in a case study. The reverse logistics process in this case study involves a three-link supply chain for microcomputer products, in which products are returned to supplier from an end user, and then from the supplier to a wholesaler. This model explores opportunities for cycle time reduction in the returns process of a large wholesaler of microcomputer products and services. The company markets nearly 100,000 products from approximately 1,000 of the world's leading hardware manufacturers and software developers to a worldwide customer base of over 100,000. This organization potentially may process \$50 million worth of returns in a given month roughly.

The company provides a variety of services including direct fulfillment which is a program where a vendor holds no actual inventory and is solely a sales and marketing organization. As shown in Figure 2.7, once an order is received from the customer, the direct fulfillment vendor (DFV) has the wholesaler ship the product(s) to the customer. The package has the DFV's name on it so the whole process is seamless to the customer. By holding no inventory, DFVs are able to offer lower prices. While the relationship between the DFV and the wholesaler works smoothly most of the time, it is not without problems.

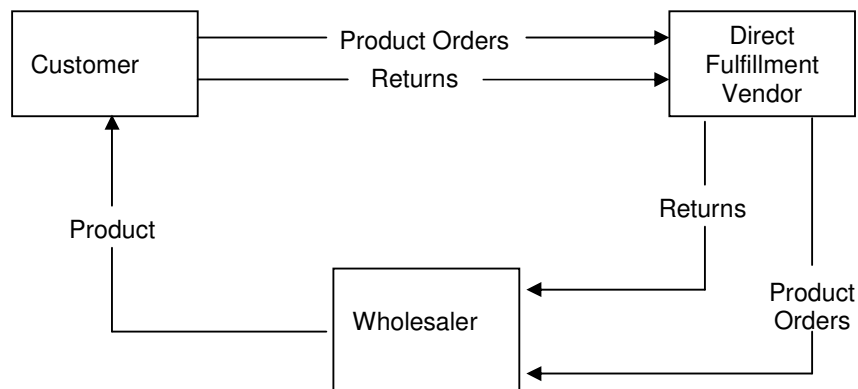


Figure: 2.7. Order/Return Process for Direct Fulfillment.

Source: Retzlaff-Roberts, D.L. and Frolick, Mark N. (1997) Reducing Cycle Time in Reverse Logistics, *Cycle Time Research*, 3:1, pp. 33.

2.5.2.1. The Direct Fulfillment Vendor Returns Process

The returns process at times can be problematic. Unlike the order process, where DFVs do not handle the product, customers return the product directly to the DFV, who in turn ships it to the wholesaler as it is shown at figure 2.7.

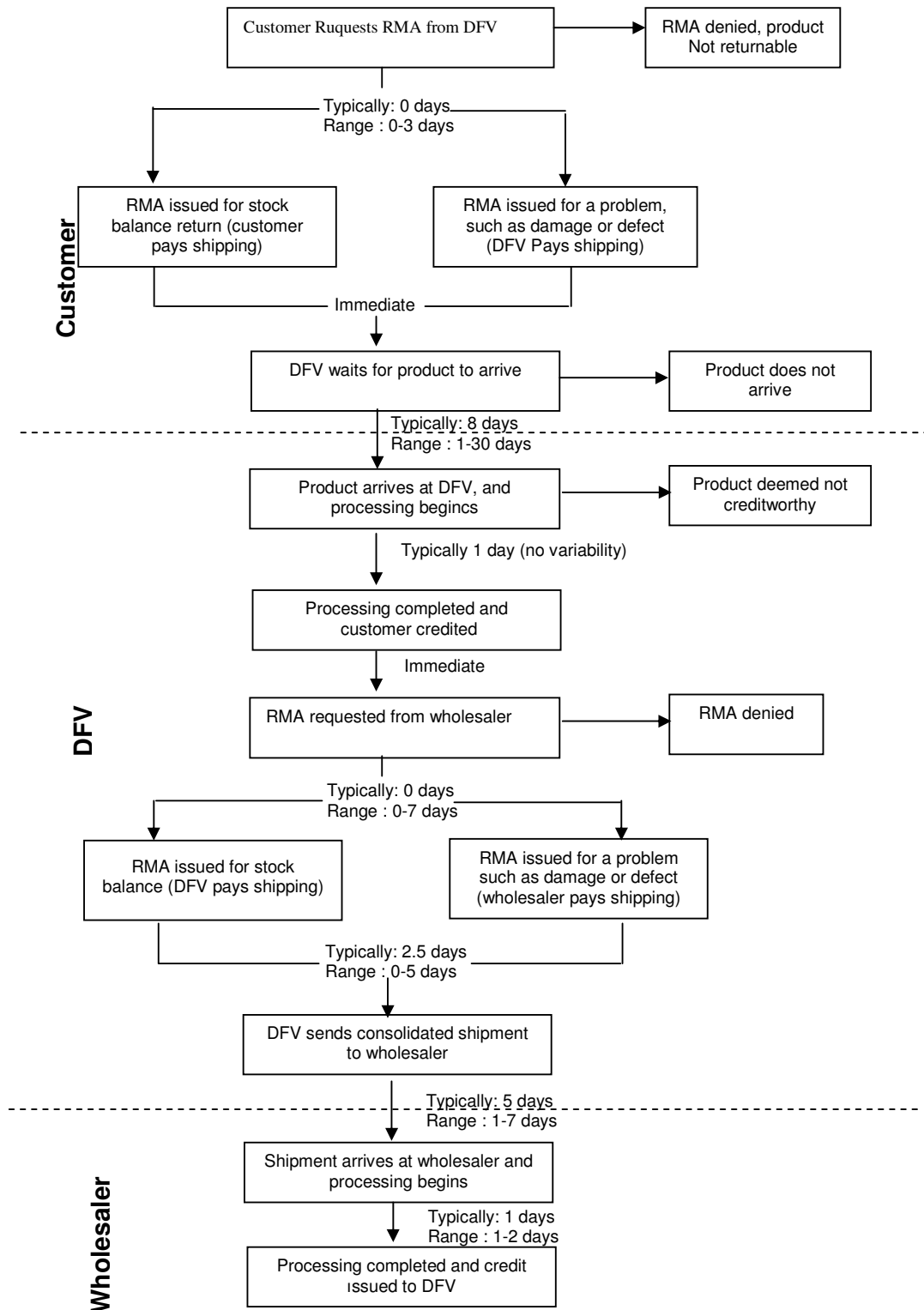


Figure: 2.8. Current Direct Fulfillment Vendor Return Process Flows.

Source: Retzlaff-Roberts, D.L. and Frolick, Mark N. (1997) Reducing Cycle Time in Reverse Logistics, *Cycle Time Research*, 3:1, pp. 35.

The product returns process in figure 2.8. begins with the customer calling the DFV. The DFV will take the customer through a question and answer session to determine if the product is returnable. For example, in the case of stock balance returns where the customer has changed his/her mind, the DFV will not accept the return unless the item(s) can be returned to the wholesaler. The wholesaler generally does not accept the return unless the item(s) can be returned to stock and subsequently be resold. This usually requires that the product packaging has not been opened, damaged, or marred in any way that would prevent the product from being resalable.

If the product is evaluated as returnable, the customer is issued an RMA number and instructions on how and where to send the product. In most cases the RMA number is issued during the initial phone call, but if there is a question as to whether the product is returnable, it may take as long as three days before the RMA is issued.

In Figure 2.8., the time involved in moving from one point in the process to the next is shown on the arrow between the two points. Thus, the amount of time from when an RMA is requested until it is issued is shown as typically being zero days, but ranges from zero to three days.

Once the RMA number is generated, the DFV must wait for the product to be shipped. Responsibility for shipping costs depends on the reason for the return. In the case of damaged product, defect, or error, the DFV pays shipping. If it is a stock balance return, the customer pays. The mode of transport is usually left to the customer's choice. As shown in Figure 2.8., the time from RMA issue until the product arrives is typically eight days, with a range of one to thirty days. However, some returns never arrive. Of the stock balance RMAs generated by direct fulfillment vendors, 20 percent of the products never arrive. Customers either forget to ship the product(s) or decide to use them.

Once the product is received, it is processed and its returnability to the wholesaler evaluated. On a stock balance return, customers sometimes indicate that a product has never been opened, but upon receipt, the DFV discovers that the product has been opened and, in some cases, used. Customers know the only returns that wholesalers will usually accept are those that can be returned to stock or are non-operational. Consequently, customers will sometimes indicate that the product meets one of these

conditions in order to receive an RMA. Product is processed at the DFV returns facility on the day it arrives. The customer then receives credit from the DFV if the product has arrived in the condition expected.

After the product has been deemed returnable, the DFV contacts the wholesaler to request an RMA. Direct fulfillment vendors typically will wait until they actually have the returned product in hand and have verified its returnability before contacting the wholesaler for an RMA. The RMA is generally not requested from the wholesaler prior to this time because the wholesaler's RMA expires within 30 days. Also, if the product was never received from the customer or was in unreturnable condition no RMA from the wholesaler would be necessary. Issuing the RMA typically takes an insignificant amount of time, but there can be a delay (up to seven days) if there is some question regarding returnability. As in the first hand-off, the "returner" (i.e., the DFV) generally pays shipping costs on a stock balance return, and the wholesaler generally pays shipping costs in the event of product defect or wholesaler error.

The next step for the DFV is to ship the product back to the wholesaler's returns facility. Since the DFV studied does a sizable amount of business with the wholesaler, returns are consolidated to reduce shipping costs. The consolidated shipment is usually sent by less than truckload (LTL) carrier once a week, resulting in a delay of up to five days. The shipping time using the LTL carrier ranges from one to seven days, and averages five days.

When the wholesaler receives the shipment, the products are processed to verify returnability, after which the DFV is credited. As shown in Figure 2, the time from product arrival at the wholesaler until credit has been issued to the DFV is one to two days.

Overall, the cycle time on the returns process ranges from 5 to 55 days and averages about 18 days. It should be noted that the high and low values, of 55 and 5 respectively, are rare.

2.5.2.2. Process Improving Steps to Reduce Cycle Time

A number of problems associated with the returns process are described below and include the delay of hand-off time, customers not following correct returns procedure, tracking problems, and others.

1) Hand-Off Time

As shown in Figure 2.8., the greatest delays involve hand-off time, which is defined as the time from RMA issue until product arrives. The first hand-off involves getting the product from the customer to the DFV, and the second involves getting the product from the DFV to the wholesaler. Hand-off time includes both waiting-to-ship time and shipping time. For the first hand-off, which typically takes seven to ten days, these two are not separated because data were not available on how long customers wait before shipping. However, since most returns take seven to ten days to arrive and can take as long as 30 days, clearly customers often wait before shipping. For the second hand-off, the DFV's practice of consolidation imposes the waiting-to-ship time. The total hand-off time between the DFV and the wholesaler would typically be about eight days and range from one to twelve days.

2) Following the Correct Returns Procedure

While the correct returns process requires that a customer first contact the DFV, some customers do not follow this procedure. A product drop-shipped to a customer has the DFV's name on the return label. However, the address is that of the wholesaler's distribution center (DC) from which the product was shipped, which can cause confusion if the customer does not contact the DFV first. Returned products sometimes arrive at the wholesaler's DC with little or no explanation. These DCs are not equipped to handle returns, thereby creating a difficult situation and needless delay.

Instructions are not always followed correctly even after the customer calls and receives an RMA. For example, for a stock balance return, the box must be unopened and in "like new" condition for the product to be considered resalable. Writing the RMA number on the box or in some other way marring the box may result in

nonreturnable merchandise. This can easily happen because the person who requests the RMA number and receives the instructions might not be the person who prepares the package for shipping.

When the package is received, the RMA number is the key to accessing the necessary return information, customers are instructed to include the RMA number on the label (and not on the box), but sometimes the RMA number is missing. The returns center must then resort to ad hoc methods to determine the RMA number. For example, knowing which customer sent the package may prompt a look through a list of outstanding RMAs for that customer, and an attempt to determine the RMA number based on the package contents. This approach is labor intensive and time-consuming. Even if the RMA number is present, it typically must be manually entered to retrieve the return information from the RMA database. Even when customers have followed directions correctly, the process is labor intensive.

3) Tracking problems

The consolidation process that some DFVs use creates several problems. First, packages can be delayed up to a week before shipping. In addition, the practice of bundling packages together, usually on a pallet, can cause tracking problems. When the pallet arrives at the wholesaler, the wholesaler signs to acknowledge receipt of the pallet. This does not acknowledge receipt of each individual RMA that was on the pallet when it departed the DFV's facility. Packages are sometimes lost in shipment, which creates a major area of contention between the DFV and the wholesaler. The DFV may indicate a package was shipped with the pallet, but the wholesaler has no record or receipt, and there is no means of tracking the individual package. To mitigate this problem, the current practice is to use express air freight for small, high value items (such as computer memory). The tracking information available when using express air freight shippers generally prevents these problems.

Wetherbe (1995; 17) proposes some recommendations for this failing reverse logistics process below involving several of the key principles of cycle time reduction basics:

1) Front-eding : Front-ending involves anticipating problems before they arise and providing a means to prevent or mitigate the problem. Front-ending can be used in several ways in this reverse logistics process.

a)Preventing Returns: The most effective way to reduce the cycle time on returns is to prevent the return from occurring. The causes of returns include some which are preventable and some which are not. Errors in filling the order, such as wrong quantity or wrong item(s), are preventable.

A preventable type of return experienced in the computer industry is when the customer perceives the product as defective. Providing technical assistance to the customer can help prevent this type of return. Another preventable return occurs when customers receive a split shipment, believe an error was made, and order more of the "missing" items. Information provided earlier would prevent this problem. A lesson might be taken from the consumer direct mail industry where each partial shipment usually contains a statement of items in the shipment and items to be shipped separately. Little can be done to prevent the customer from changing his or her mind other than to provide a mild deterrent, such as the necessity of paying for the returns shipping cost. Customers already pay return shipping for stock balance returns. Any further deterrents to returns could have the undesirable effect of being sales deterrents. Damage in transit can be reduced by better packing materials and avoiding carriers with a poor history for product damage.

b) Protecting the Product and its Box: Protecting the original manufacturer's box is also important since damage to the box often precludes returnability. For example, a DFV had a \$10,000 computer returned, and the carrier damaged the box in transit. The computer was not damaged, so the box had done its job from the standpoint of protecting the product. The carrier acknowledged damaging the box and paid for the value of the box (less than \$200). However, the DFV could not purchase a new box from the manufacturer. With a damaged box, the computer could no longer be considered new and was no longer returnable to the wholesaler. Suddenly the \$200 box is worth \$ 10,000 which means not only is a box needed to protect the product, but a shipping carton is needed to protect the original box. Thus, an additional step that could be taken,

particularly for expensive items, is to institute the practice of using a shipping carton to protect the original manufacturer's box.

c) Making Returns Easier to Process: Accepting that some returns are inevitable and going to occur, the next issue is to make the process go as smoothly as possible for all parties. From the DFV and wholesaler's perspectives, returns would be improved if customers followed directions and if the RMA labels were scannable. To help ensure that customers follow directions, the front-ending might require "idiot proofing" the process as much as possible. As discussed earlier, customers do not always follow the process correctly. For example they may send the product to the wrong place. The correct process for the customer should be as simple as possible and readily apparent. Again, a lesson might be taken from the consumer direct mail industry where a return form and instructions are included with every shipment. These steps would reduce errors, make the process easier, and help reduce the process cycle time.

2) Partnering: Two kinds of partnering are possible. The first is partnering with one or more freight carriers that are capable of providing a scannable label for the return product at pickup. Potentially a second type of partnering could involve one or more long standing customers with good track records. From the customer's perspective the most important step in the returns process is receiving credit from the supplier. Customers would like to receive credit at the time the RMA number is issued. Suppliers are understandably reluctant to do so until they have received the product and determined it to be credit worthy. For a major customer where the relationship is stable and trust has been developed, a supplier might consider issuing credit earlier as a service to the customer, agreeing that the account would be debited if the product was not found to be returnable. This would only work only if the customer acts in good faith and sends the product promptly.

3) Eliminating and Informating: As shown in Figure 2.8., the handoffs consume the majority of the cycle time in the returns process. The DFV returns facility exists only to provide information and greater control for the DFV. Prior to the creation of the DFV returns facility, customers did return products directly to the wholesaler. The problem with this process was the lack of tracking information. When the DFV received credit from the wholesaler, the DFV did not necessarily know which RMA(s) were being credited, thereby placing the DFV in an information vacuum resulting in a lack of control.

Creating the DFV returns facility filled the need for both information and control, but also created an additional hand-off, increasing the cycle time, the total amount spent by all parties on shipping, and overhead for the DFV. If the hand-off could be accomplished with complete tracking information, it would be possible to eliminate the DFV returns facility and have customers again return directly to the wholesaler.

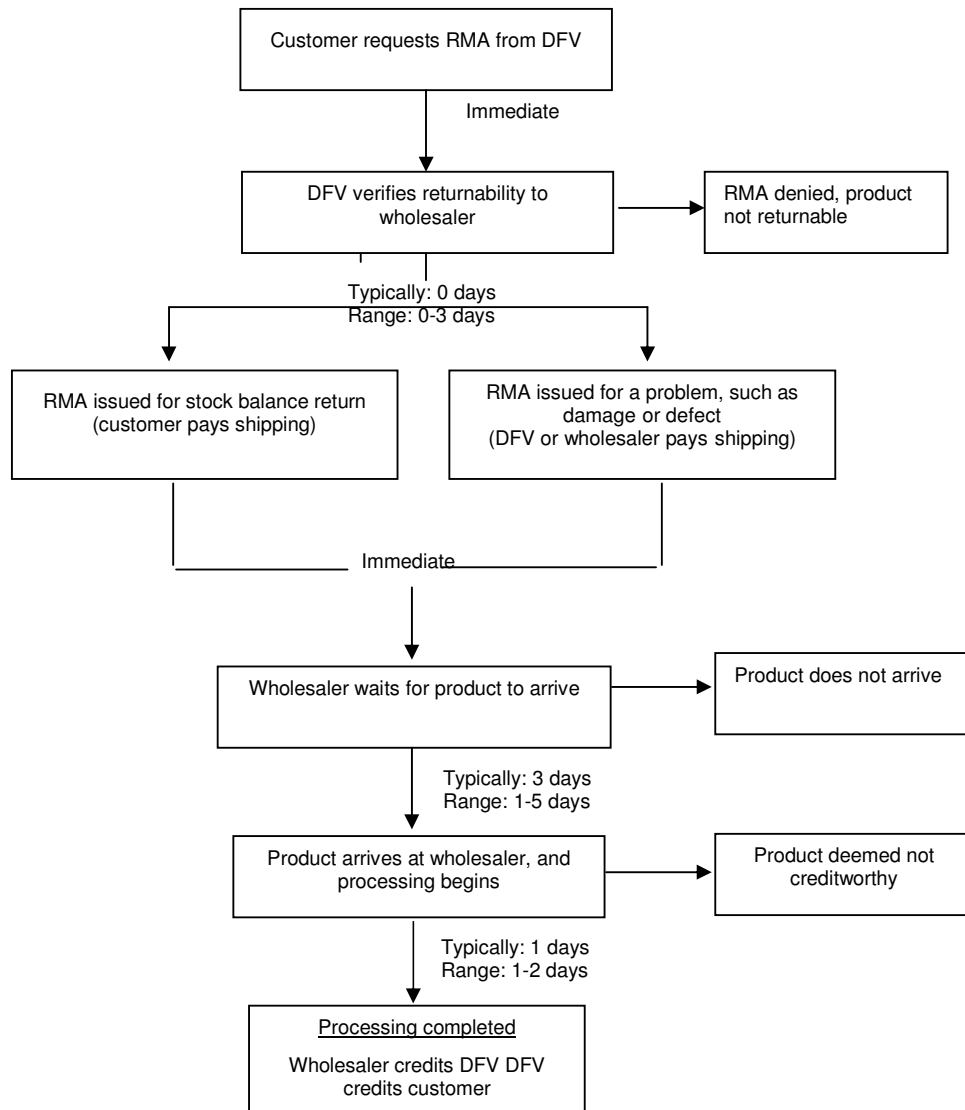


Figure: 2.9. Proposed DFV Returns Process Flow

Source: Retzlaff-Roberts, D.L. and Frolick, Mark N. (1997) Reducing Cycle Time in Reverse Logistics, *Cycle Time Research*, 3:1, pp. 40.

Informing, so that tracking information is available to both the DFV and the wholesaler based on a single tracking number, is necessary for this process to work. Providing a scannable label to the customer and having appropriate tracking and information systems would enable both the DFV and the wholesaler to access the status of each return. This could be accomplished by partnering with a freight carrier that is capable of providing this type of service.

This modified returns process is shown in Figure 2.9., and would be similar to the process that was in use prior to creation of the DFVs returns facility, except that tracking information would be available. The process would begin the same way, with the customer contacting the DFV to request an RMA. The DFV could utilize the same question and answer session to determine if the product is returnable. If the DFV is satisfied that the product is returnable, the wholesaler would be included now to approve issuing an RMA as well. When the RMA is issued a carrier could be dispatched to the customer with a scannable label. If the carrier arrived to pick up the package on the day the RMA was issued, waiting-to-ship time could be virtually eliminated.

The duration of shipping, as well as the cost, would vary based on the urgency of the return. Processing time at the wholesaler's facility would be reduced by having scannable labels, making the process less labor intensive and time consuming, allowing packages to be processed on the day of arrival. At this point the wholesaler would credit the DFV who would in turn credit the customer.

This proposed returns process will obviously improve customer service from the wholesaler to the DFV and from the DFV to the customer. It would reduce overhead cost for the DFV, in that the DFV would no longer need a returns facility. Packages would be shipped once instead of twice, reducing overall shipping cost. In the current system for a stock balance return, the customer and the DFV each pay to ship the package once in the proposed system the customer could still pay, resulting in additional savings for the DFV; or perhaps some arrangement of sharing the cost could be used if the package is returned promptly, thus providing an incentive for the customer to return promptly. For non-operational returns, currently the DFV and the wholesaler each pay to ship the package once in the proposed system, they might also arrange some means of cost sharing. On the issue of cycle time, there would be a considerable reduction from

about 18 days to just a few days. The hand-off between the customer and the DFV is a major time consumer, involving both waiting time and shipping time. To reduce waiting time, some means of motivating customers to send packages more promptly, is needed. This could be done either with an incentive to ship promptly or a disincentive for not shipping promptly. As in the above scenario, the duration of shipping could vary based on the urgency of the return.

For the second hand-off, an alternative approach from the DFV to the wholesaler is needed. Consolidation is causing needless delay, as well as tracking problems. One alternative is to discontinue consolidation. This would eliminate the delay caused by consolidation and prevent the tracking problems that are currently causing problems between parties.

One of the main key factors of today that will also be topics of tomorrow is competing on cycle time and cost besides competing for quality and customer satisfaction. Cost and cycle time are important issues, since, especially in global logistics costs incurred are higher and timing of delivery due to long distances matter. Logistics firms must carry out the paradoxical task of providing exclusive products at low cost, high-quality and at short delivery times (Tanyeri and Tavmerger, 2004; 20).

2.5.3. Process Reengineering to Improve Customer Service Quality

In addition to the previous case, the reverse logistics study described in this case is driven by customer satisfaction. It involves a direct marketer reengineering the current reverse logistics processes for improved customer service quality by reducing the cycle time of providing refunds and exchanges to customers, with a secondary objective of increased operating efficiency of processing returned items.

In this study Amini and Retzlaff-Roberts (1999; 33) gives the following information about the organization and the characterization of the model. The organization is a direct marketer of apparel and other goods with sales in excess of 1,000,000,000 dollars annually. The forward distribution process is efficient and effective with most customer orders being shipped within 24 hours. During the busy holiday season well over 100,000 packages may be shipped daily. Customer satisfaction is a high priority.

They explain that in the spirit of continuous improvement, management is eager to explore new opportunities to enhance customer satisfaction with the returns process. The means of increasing customer satisfaction are; reducing the cycle time of customer receipt of the refund or exchange, and increasing the convenience of sending a return.

A disadvantage in direct marketing is the inconvenience and time involved in returning an item. Most direct marketers try to mitigate this inconvenience by providing a return form and a preaddressed shipping label with each order. Amini and Retzlaff-Roberts (1999; 34) defines that, the typical return process for a customer of any direct marketer includes; filling out the return form or writing a letter to the direct marketer to indicate the reason for the return and the requested action, such as exchanging for another item, issuing a refund check, credit a credit card, etc, repackaging the item and enclosing the paperwork, going to the post office and standing in line to have the package weighed and postage assessed, waiting for the package to be received and processed, then waiting for the requested action to be completed by the direct marketer.

They also underline that all of these processes described above are time consuming and inconvenient for the customer. The inconvenient of the return process is often cited by consumers as a major deterrent from ordering from direct marketers. Finding ways to reduce the inconvenience and cycle time of a customer return should increase customer satisfaction, increase customer retention, and enhance sales. A reengineered returns process is modelled with these as the means of enhancing customer service.

2.5.3.1. Current RL Process

The reverse logistics process begins when a customer decides to return one or more products. The majority of the time these are new products which the customer has recently ordered and received. In addition to return of new products, customers also return used products that they feel did not live up to expectations, so these would fall under the category of warranty returns.

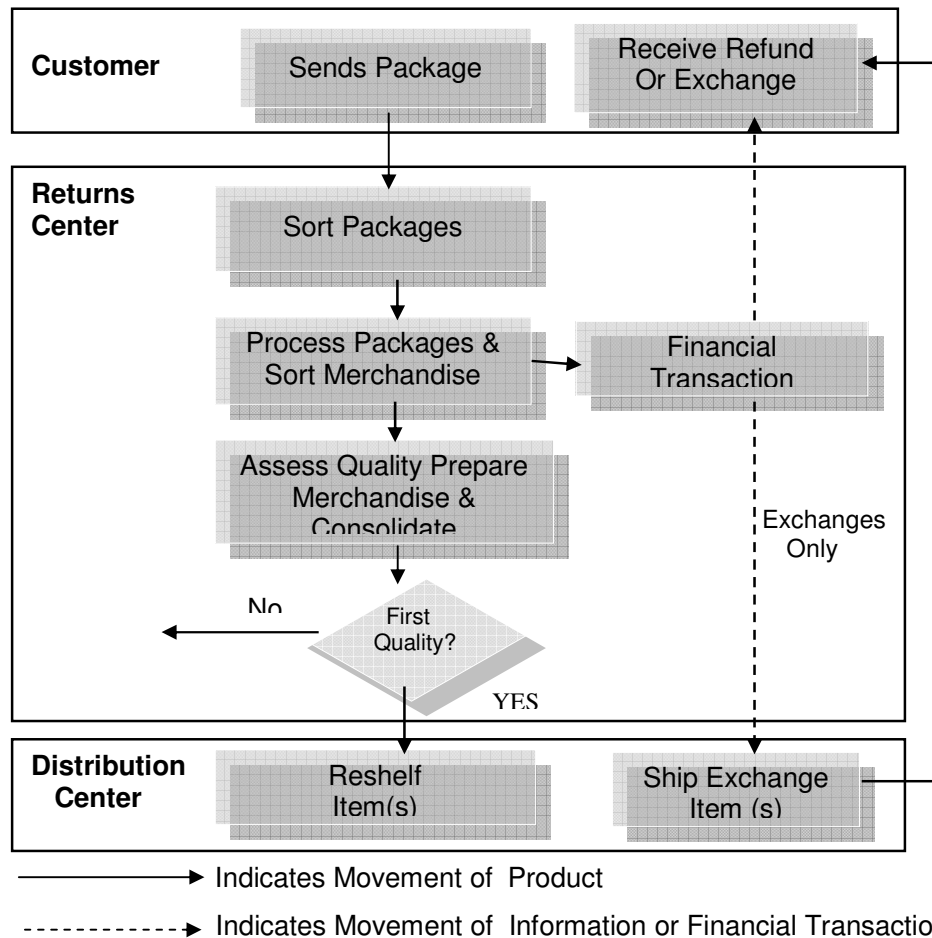


Figure 2.10. Current Reverse Logistics Process

Source: Amini, Mohammad and Retzlaff-Roberts, Dona. (1999) Reverse Logistics Process Reengineering: Improving Customer service Quality, *International Journal of Physical Distribution and Logistics Management* pp.34.

Regardless of whether the product is old or new the customer will request either an exchange or a refund. Figure 2.10. above depicts a simplified version of the current reverse logistics process map. This includes numerous processes to effectively manage arrival of a large volume of packages containing items from a variety of product lines. These packages need to be sorted and routed to the correct locations. In package processing each package is opened, its paperwork read, and its contents assessed and sorted by product line. This is the point at which the customer transaction is separated from the merchandise and the two processes proceed independently and in parallel.

The documents are transferred to the financial transaction process, where depending on the initial means of transaction - credit card, personal check, or gift certificate - customers are reimbursed for the returned merchandise. If an exchange has been requested, the appropriate information proceeds to the distribution center, from which the exchange item is shipped. This completes the customer transaction process.

Meanwhile the merchandise has been removed from the package and sorted into the various product groups. It is then conveyed to the appropriate merchandise preparation area. Here the quality of each item is assessed and the item is prepared as needed for its destination. First-quality items are repackaged for return to the distribution center. Lower quality items go to a variety of destinations depending on their condition. For example, some items are donated to charity while the lowest level of quality is discarded. Items are consolidated and shipped to the appropriate destination.

It should be also noticed that the customer financial transaction waits to commence until the package has been received, opened, and its contents assessed. Only at this point can the information needed for the customer financial transaction be separated from the merchandise. This is the usual procedure in virtually all return processes; the merchandise must be in hand before any further transaction takes place. The bulk of the time from when a customer decides to return something until the financial process can begin is taken up by the shipping time.

2.5.3.2. Proposed RL Process

The innovation of the proposed process is that the shipping time is removed from the customer transaction by having customers call first and use a scannable postage-paid label. As shown in figure 2.11., customers would call first to indicate what they are returning and specify the details of the desired exchange or refund. The return label would have been provided with the order. Having the label postage paid provides a significant convenience to the customer which is the ability to skip standing in line at the post office. (The customer would be charged a nominal fee for using the label. This is not about providing free shipping but providing motivation to increase convenience). When the carrier receives the package, the label would be scanned and the information transmitted to the direct marketer. This allows the information to be separated from the merchandise at a

much earlier point in time so that the customer transaction can be completed without the delay of waiting for the package to arrive.

When the package arrives at the returns center all that remains is to reconcile the transaction and do the usual merchandise preparation. Information on the scannable label would allow the package to be sorted prior to opening it, based on the product line. This means the returns center could be restructured to combine package processing and merchandise preparation into one operation for each product line, thereby avoiding the duplication of effort that occurs in the current process. This restructuring would make it possible for the merchandise to be handled and assessed by only one person. All of which creates an opportunity for redesigning the returns center in a way that increases the internal operating efficiency.

In this model the primary objective is to enhance customer service by reducing the cycle time of the customer transaction, and increasing the convenience of making a return. The former is achieved by separating the merchandise from the information much earlier in the process. The latter is achieved by the postage paid label which allows customers to skip waiting in line at the post office. It is clear that the proposed process would achieve enhancing customer service.

The ability to route unopened packages to the correct product line via the scannable label increases operational efficiency. A reengineered returns center increases operating efficiency by reducing the cycle time of moving merchandise through the returns center.

This study has shown an example of reengineering a reverse logistics process whereby customer service can be improved while simultaneously reducing operating cycle time. This example, which was not in any way motivated by compliance with environmental regulations (as many reverse logistics efforts are), shows how competitive advantage can be achieved from reverse logistics. For this reason reverse logistics is and will continue to be a growing field and should be viewed as an integral part of the organization's overall supply chain.

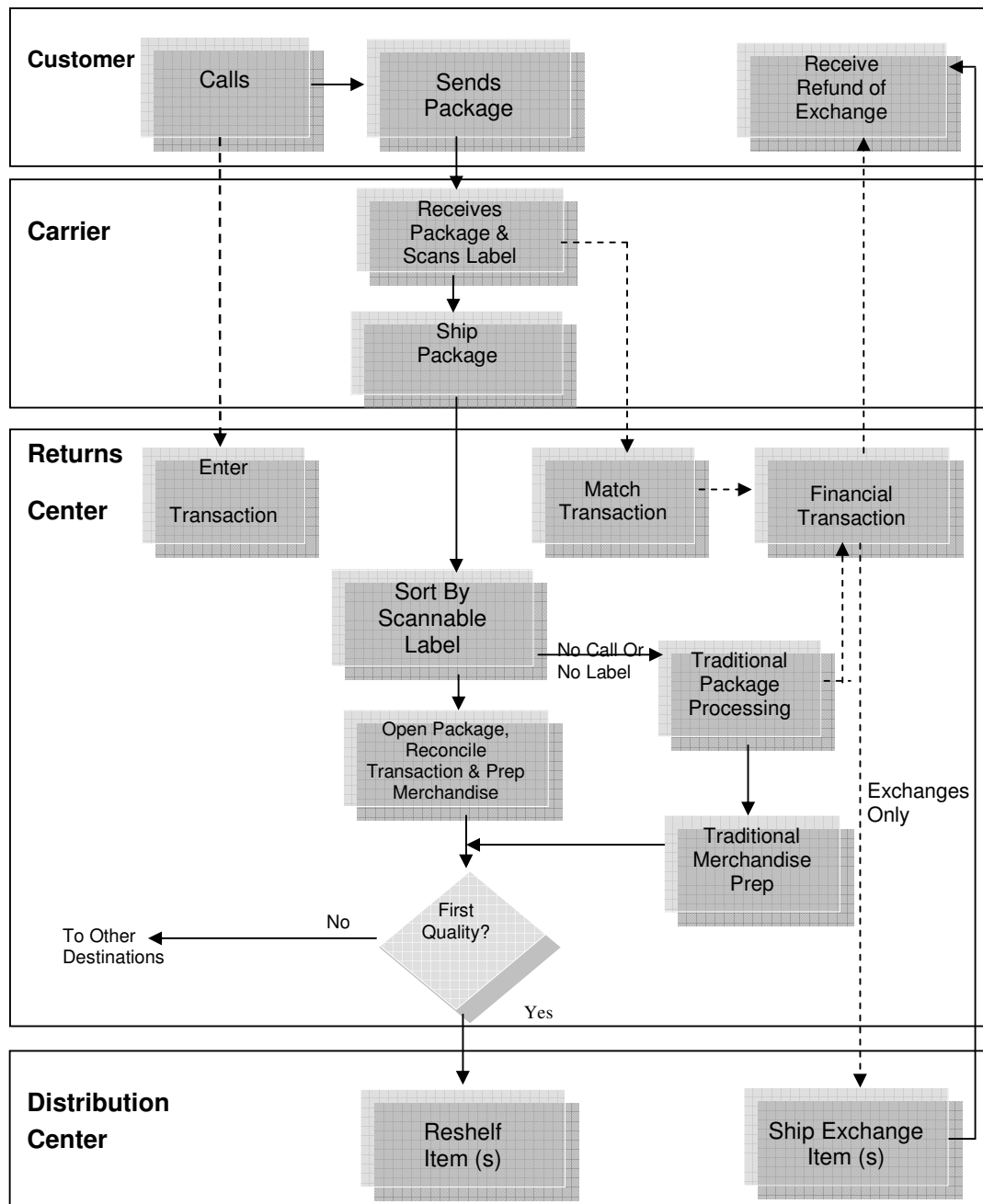


Figure 2.11. Proposed Reverse Logistics Process Map

Source: Amini, Mohammad and Retzlaff-Roberts, Dona. (1999) Reverse Logistics Process Reengineering: Improving Customer service Quality, *International Journal of Physical Distribution and Logistics Management* pp.36.

2.6. 3PL Services and Characterization of RL Networks For Outsourcing

2.6.1. 3PL Services and Characterization of RL

Economic pressures for corporate profits are forcing manufacturers and retailers to look very hard at cost controls. Reverse logistics is one of the few remaining opportunities that has not yet received much attention (Kroon and Vrijens, 1995; 58). Manufacturers, distributors and retailers are struggling with the reverse logistics. Industry experts suggest the annual costs of reverse logistics total \$35 billion. Product returns handling is an important process of the supply chain that is not well handled. In addition to manufacturers, distributors, and retailers senior management of 3rd party logistics providers (3PLP), outsourced service providers and CEOs better to take a close look at reverse logistics as an excellent strategic source of value added revenues.

Many manufacturers and retailers are looking to outsource reverse logistics and product returns since it is not a strategic part of their business. Most of them currently have very inefficient, slow and expensive processes for handling returns. Few tools or systems exist to assist in handling returns effectively. Unfortunately, as a result considerable value is lost when these returned assets are not processed quickly and completely.

For most companies currently the challenge is just getting a return fully processed effectively, inexpensively and in a timely manner. So, the management of reverse logistics is a painful process for manufacturers and retailers not having these capabilities. Or it is also a small part of their business and they are often not willing to commit the people, systems or resources to this area to manage it well. Since little number of firms have these capabilities or since it is very costly to the firms, few standards exist to define how to process and manage returns, but unfortunately these processes are related to forward logistics processes. As a result, RL is an easy extension of the existing 3PL business, creating a lot of value for customers and this translates into profits.

Third Party Logistics Providers (3PLP) and Outsourced Service Providers are ideally suited to manage reverse logistics, since the skill sets used to process forward and reverse logistics are similar. Reverse logistics, however, encompasses much more than accepting inbound shipments from client's customers. Traditionally, product returns are

something that 3PLs try to avoid. However, with a solid understanding of reverse logistics needs and processing, reverse logistics represents a quick and excellent source of high volume transaction fees that can be generated from existing facilities and skill sets (Rupnow, 2002a; 1).

"As companies strive to wring every cent out of their logistics costs, they're increasingly taking a hard look at their reverse logistics practices. And no wonder - they may find a mother lode waiting to be mined (Harps, 2002; 21)". So, reverse logistics services is an opportunity for outsource providers to provide additional services for new revenues from existing customers, differentiate company's services from those of competitors, attract new clients to these services, enhance status in the global supply chain.

Currently most retailers and manufacturers struggle with handling and processing returns internally. Many manufacturers conclude that handling product returns is not a strategic core competency and will look for an outsourced provider, as they have mostly done with forward logistics.

Most retailers and manufacturers struggle with returns for many reasons such as; it is a small part of their business processes, their focus is getting new products to customers, they have difficulty understanding and controlling costs, there is poor or no systems for managing the returns processes, a lack of systems results in slow processing of the returns and the returned inventory, inability to track or monitor inventory levels of returned stock, few good channels exist to get value from their returned and processed units (Rupnow, 2002b; 43). In short; returns can be a significant problem if not managed well. Without good systems in place significant individual attention is often required to manage a single return to competition.

Since reverse logistics is an easy extension of the existing business services of 3PL operations such as; many of existing customers likely already need help, the existing company is already master at: many of the required processes, expert at managing outsourced projects, tracking and managing inventory, minor inspection work, minor reconditioning or repackaging, likely to generate significant savings in shipping, ability to rapidly process transactions, enable solving key problems of slow processing (Harps, 2002;

21). Outsourced logistics providers and 3PLs are ideally suited to help handle reverse logistics and generate significant savings.

The customers in RL industry will be looking for; cost savings, easy management, regular status updates, one stop shopping (one provider who can handle as many of their requirements as possible), a partnership (the nature of returns will require a close working relationship), quality service for their customers, rapid cycle time (through create, receive, ship or credit, inspect, recondition, recover), accuracy (correct handling of units through each step of the required processes), inventory management and minimization (of both finished goods and good in process), no misplaced or unhandled units, visibility (status of a unit or RMA at any given time), timely data updates (i.e. to process customer credits based on receipts), reports, detailed billing (Rupnow, 2002a; 7). So, this special process of outsourcing reverse logistics should be handled neatly like other outsourcing decisions.

2.6.2. Characterization of Reverse Logistics Networks For Outsourcing Decisions

Once products have reached the end of their useful life, they may be able to be remanufactured, refurbished or repaired; thus extending their life. These options can provide significant benefits in some instances, especially for products that have modular components (e.g. electronic equipment, computers) that can be replaced, upgraded and/or refurbished (Stock, 1998; 54). Naturally, the value of items that are remanufactured will typically be less than the same items produced for the first time. On the other hand, their value will be substantially higher than items being sold for scrap, salvage or recycling.

As previously mentioned, currently estimates of annual sales of remanufactured products exceed \$50 billion in the US alone. There are no worldwide estimates of the economic scope of reuse activities, but the number of firms engaged in this sector is growing rapidly in response to the opportunities to create additional wealth, and in response to the growth in extended producer responsibility legislation in several countries. Unfortunately, even with this significant development for the RL market in recent years, not

enough analytical models currently exist which assist in RL strategic decisions (Guide and van Wassenhove, 2003a; 33).

The RL systems classification is an attempt to develop particular decision-making tools according to the characteristics of the RL network. The planning, executing, controlling and optimizing activities performed in a RL system, or the decision to outsource these activities to a 3PL, will largely depend on the type of network that the firm is dealing with (Serrato, 2005; 2). For this reason it is relevant to structure and classify the existing RL systems in the US market, as well as worldwide.

Strategic decisions about RL are complicated by the uncertainty of product returns. To aid firms in deciding whether to outsource RL activities or not a characterization of RL networks according to two critical factors were studied. These factors are the length of the product life cycle (PLC), which affects variability of expected returns over time, and the uncertainty of the rate of returns in each time period.

Tibben-Lembke (2002; 226) makes a clear explanation of the importance of considering the product life cycle to analyze RL systems, which is one of the factors considered in this categorization. This author explains the different behaviors that can be expected for the amount of returns, according to the length of the life cycle, depending on the type of product that the company is dealing with.

On the other hand, Guide and van Wassenhove (2003a; 24) state some relevant business aspects for several RL systems, describing the most important variables for them. But they do not state clearly the characteristics of the life cycle for the products managed on any RL system, which is a critical issue to consider when analyzing any RL network.

As mentioned before; considering and evaluating RL functions often as non-core operations for most organizations, they are not always willing to perform them by themselves. These activities would just represent a distraction of the firm's attention away from its core activities. Even more, as the basic economic justification for any form of

outsourcing is the economy of scale associated with specialization (Daugherty and Drögue, 1997; 343). This strategy is significantly relevant in RL programs. A complete analysis of the partnerships or alliances in RL systems is necessary to achieve optimal results, and multiple organizations might be involved in the RL functions.

Therefore, one of such critical strategies in RL systems can be identified as whether or not to outsource these activities to a Third Party Reverse Logistics Provider (3FRLP). Brito, Flapper and Dekker (2002; 12) show some of the critical success factors in RL, while Razzaque and Sheng (1998; 94) develop a comprehensive literature in outsourcing logistics functions. On the other hand, Rabinovich, Windle, Dresner and Corsi (1999; 365) make an examination of the current industry practices for outsourcing integrated logistics functions. But even extensive research has been performed in relation to outsourcing logistics functions, not enough research has been made on the specific case of outsourcing RL activities.

Furthermore, once the decision to outsource a defined set of RL functions has been taken, the selection of a 3PRLP is a critical issue to consider too.

2.6.2.1. General Characteristics of RL Networks

Networks structures in RL have several characteristics that differentiate them from the typical supply chain. First, RL networks encompass several supply chain stages. In this sense, RL fits well in the mindset of SCM, advocating coordination of the entire supply chain rather than considering single stages independently.

Roughly speaking, forward networks correspond to distribution networks encompassing supply, production and distribution stages as shown at figure 3.12. Fleischmann (2001; 52) defines the major differences between both contexts appear at the supply side. In traditional production-distribution systems, supply is typically an endogenous variable in the sense that timing, quantity and quality of delivered input can be controlled according to the system's needs. In contrast, supply is largely exogenously determined in RL chains and may be difficult to forecast. Hence, supply uncertainty is a major distinguishing factor between forward and RL Networks.

In a typical forward chain, the demand for the good is uncertain, but the supply is known (to a certain extent) and can be considered as a decision variable. As Kouvelis (2002; 722) states, this demand and supply uncertainty leads to alternate conclusions regarding the degree of outsourcing in both networks: usually, greater supply uncertainty increases the need for vertical integration in forward chains while greater demand uncertainty increases the reliance on outsourcing depending on the specific characteristics of the network.

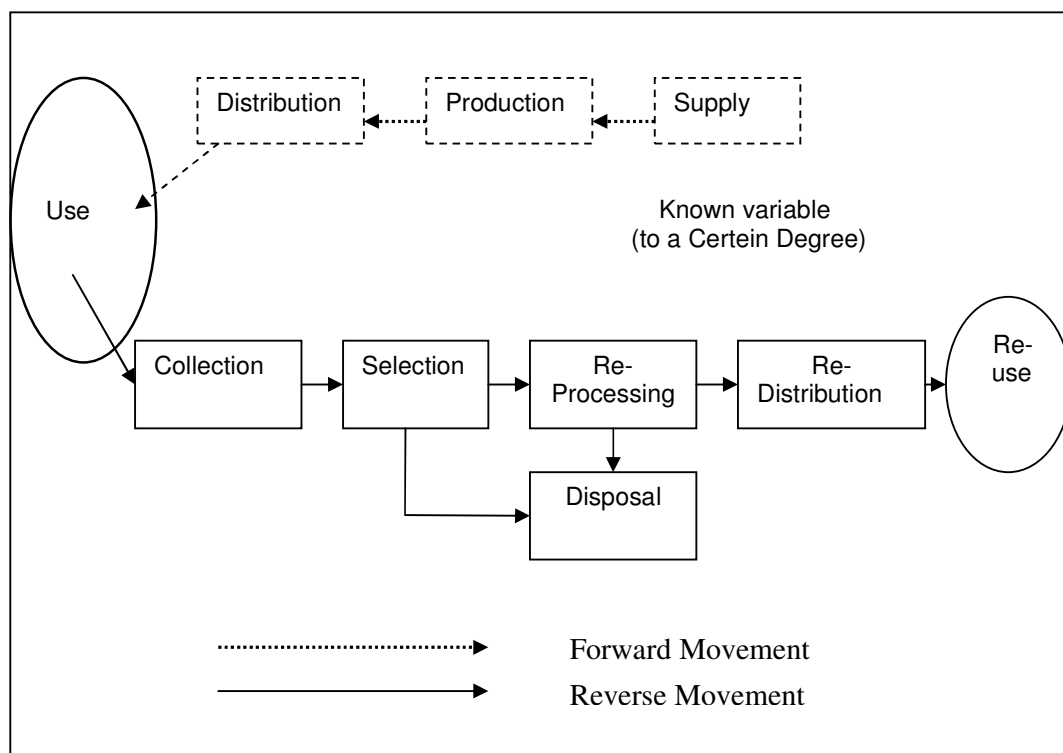


Figure 2.12. The RL Chain

Source: Fleischmann, M., Beullens, P., Bloemhof-Ruwaard, J.M., & Wassenhove, L.V. (2001). The Impact of Product Recovery on Logistics Network Design. *Production and Operations Management*, 10 (2): 162.

Forward networks typically do not include an inspection stage similar to RL networks. Destinations of goods flows are, in general, known beforehand with more certainty as compared to the quality dependent processing routes in RL chains. While there may be some particular exceptions, this is not the major focus of traditional forward

networks (Serrato, 2005; 6). Therefore, network structures may be more complex in RL, including more interdependencies. Another element that may lend RL networks a higher complexity is the potential interaction between collection and redistribution, e.g., combined transportation in closed-loop networks. However, this network complexity depends on the specific recovery process and may vary considerably.

Another fundamental difference between forward and RL networks is identified in the number of sources, which tends to be fairly large in RL as compared to the number of supply points in a traditional setting. Bringing together a high number of low volume flows therefore appears to be characteristic of RL networks in particular. However, both networks can also be analyzed together. As Guide and van Wassenhove (2003a; 29) state, closed-loop supply chains (which are composed of the typical forward-supply network and the RL network) can be viewed as a business proposition where profit maximization is the objective. The characteristics of such maximization will depend on the forward supply chain characteristics, as well as the RL network composition.

2.6.2.2. Factors Considered For The RL Networks Categorization

As specified before; the RL networks categorization is based on two factors that determine the structure and characteristics of every RL system. These factors are the length of the product's life cycle and the variability in the rate of returns in any particular period. The length of the product life cycle varies across products and industries.

Since it is not easy to identify where a real product is in the life cycle once it moves past the introductory and growth stages, every firm must look for demand turning points. These can be seen if the company understands past history and the marketplace, and will allow the firm to understand the expected behavior for the volume of units returned through its RL system (Rogers and Tibben-Lembke, 1999; 138).

One of the most important difficulties for every firm, when analyzing the life cycle of its products is to admit that it is at the end of its life cycle. However, if this challenge is faced adequately product life cycle analysis can become a critical piece for an adequate RL system management.

The stage where a product is located in its life cycle is significantly related to the amount of units returned through its RL network. Competitive environments have caused the product life cycle for many consumer goods to continually shrink (Guide and van Wassenhove, 2003a; 34). As an example, many consumer electronics such as mobile telephones, have less than six months between new model introductions. Products such as these that have a very short shelf-life and that can be restocked without furthering handling may best be returned to the originating distribution center (Gooley, 2003; 40). One example is catalogue sales, where items that come back unopened can almost immediately be returned to inventory and become available for sale. This situation significantly facilitates the RL management. However, this is not the case for all types of products.

The management of the product returns process in a timely and effective manner in the case of short life cycle goods presents enormous difficulties compared to products whose life cycle length is longer. But it is relevant to look not only at the length of the product's life cycle, which affects the expected amount of returns in each period, but also at the variability around the expected value during each period in the cycle.

Serrato (2005; 8) underlines that; characterizing products according to average amounts of returns is not sufficient since the variance of return volumes will also affect the structure and configuration of the RL system developed to deal with them.

2.6.2.3. Product Life Cycle and The RL Network

In today's business environment all products are not fortunate enough to have specific periods of growth and stability. Many products either fail to have any significant sales or have short sales lives.

If the product has a very short life, the retailers may return large volumes of unsold product to the manufacturer. A typical example for this type of behavior is the computer market. Tibben-Lembke (2002; 231) reminds that; in this sector, the introduction of new components accelerates the demise of computer models previously introduced, as the manufacturer must introduce new models, just as its competitors are doing, that will reduce the sales of the existing models.

In this concern; in order to understand the RL flow behaviour, it is relevant to look at the product's life cycle. Tibben-Lembke (2002; 232) identifies six phases that are defined during the life cycle of any product: development, introduction, growth, maturity, decline and cancellation. Figure 2.13. shows the expected sales volume during these stages.

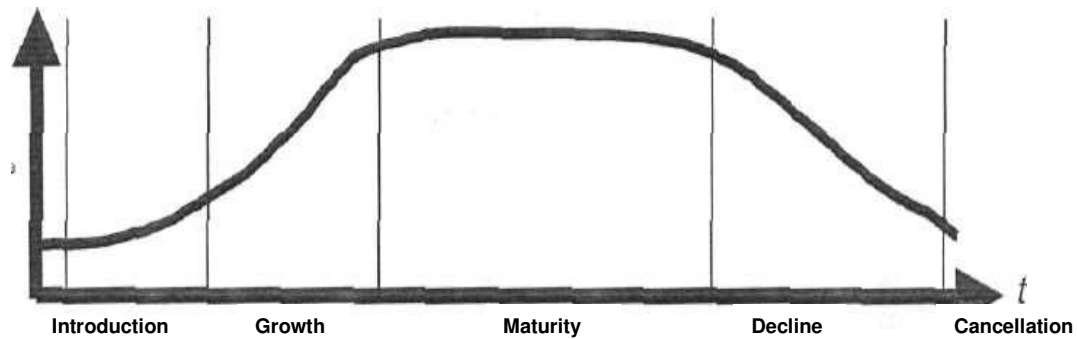


Figure 2.13. : Stages of Product Life Cycle.

Source: Tibben-Limbke, R. S. (2002). Life after death: reverse logistics and the product life cycle. *International Journal of Physical Distribution & Logistics Management*. Vol. 32. No. 3. pp. 231.

In the nature of PLC the amounts of units returned during each one of these stages differ significantly. Tibben-Lembke (2002; 232) describes the major issues that define the volume of the units returned through the RL system for a product model during six phases that detailed below:

1. Development phase: When a new model of an existing product is being developed, few challenges are to be expected in the development phase. Because the new product has minor changes compared with the old, clients that buy the current product are likely to be interested in the revised product, and the RL policies and procedures for dealing with the old product are likely to work satisfactorily with the new.

2. Introduction phase: Early in the introduction stage, the firm can begin making plans for dealing with the products which eventually be returned. As with a new form of an established product, clients will be familiar with the product and be able to estimate the demand in the secondary market.

During the introduction stage, the company must also begin dealing with the flow of returned product. Because in most cases a new model is a minor modification of the existing product, production difficulties in adapting to the new model should be minimal. The minor modification also means demand for the new model would be expected to be very similar to demand for the previous model.

3. Growth phase: Increasing sales of a new model are unlikely to lead to production difficulties. Although the rate of returns (as a function of the sales volume) may be unchanged, during this phase, returns volume will substantially increase, as sales increase. However, as more customers are attracted to the product, these new customers may be less knowledgeable about the product, and the rate of non-defective defectives may increase. In the same vein, the variability in the rate of returns between consecutive periods is expected to increase.

4. Maturity phase: As sales for the model reach its maturity stage, the amount of returns will also be expected to reach a stability period. Given a relatively constant amount of units sold per period, the volume of returns will also be expected to reach such stability. However, it is important to note that the volume of returns in a particular period is related not with the volume of sales in the same period, but with the historical sales in the previous ones. Though the firm might reach this stability in its sales volume, the variability in the rate of returns between consecutive periods may increase.

5. Decline phase: In forward distribution, during this phase, the company is trying to determine how long it can continue to sell the product profitably before it needs terminate it. In RL, the company does not directly decide when to stop accepting returns. Rather, the last date for allowing returns of a product will depend on the company's returns policy and the date of the last sale of the product. If, for example, customers can only return a product for 90 days after the last sale, then returns may come to the retailer as long as 90 days after the last sale.

As sales of the product fall, its price on the secondary market also is likely to fall. However, if the model sales are declining because a newer, similar model has been introduced, secondary market firms will be very interested in purchasing

the product. Because this product is similar to its newer replacements, value retailers will be eager to be able to sell a model that is not very different from the newest models.

6. Cancellation phase: When a product reaches the end of its life, the volume of customer returns will continue to decrease before stopping altogether. Even if the product has sold well, at the end of its life, retailers may send any unsold product back.

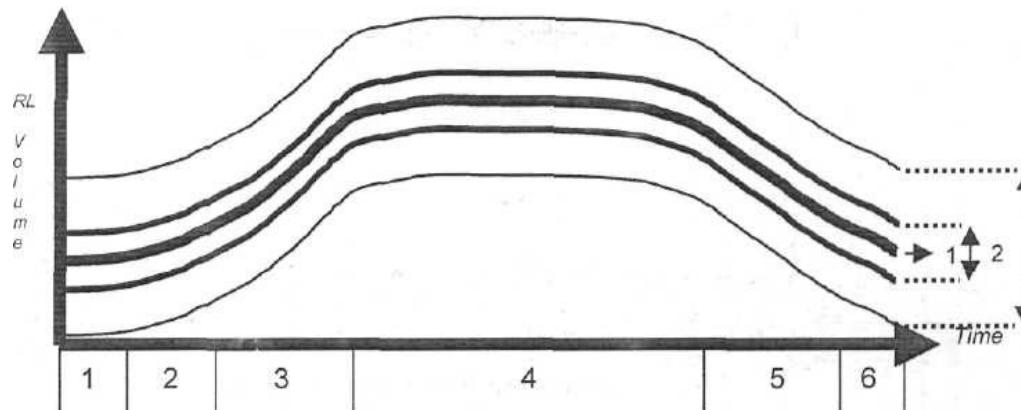
Despite the fact that sales of this model are falling, sales of similar, but newer models will unlikely continue to be strong. Therefore, the secondary market demand for the product will remain strong. This implies that the secondary market demand for the product will remain strong. Some other firms might be interested in buying up all remaining product at the end of the product's life, although vendor restrictions about product placement will remain high.

The PLC strongly determines the expected amount of returns for a particular product over time. However, the characteristics of such returns will also depend on the length of the life cycle, as well as the particular characteristics of that product. By the way, it should be taken into consideration that not all products or industrial sectors have similar length for its product's life cycles.

2.6.2.4. Variability in The Rate Of Returns

The variability in supply is much greater in RL channels due to the many uncertainties associated with product and material life return rates. To cover the different amounts of variation faced for different products, particular return rates need to be considered. For example, commercial returns from retail and Internet-based sales are a concern in North America and a growing concern in Western Europe. In 2001, the cost of returns for Internet sales was averaging twice the value of the product (Guide and van Wassenhove, 2003b; 13).

Though different products may have equal (average) return volumes for each life cycle stage, the variability about that average can be significantly different. Higher variability complicates the management process for these returns. Figure 2.14. shows graphically this behavior.



- 1: Expected amount of returns (equal for both products).
- 2: Confidence interval for the amount of returns for a product with low variability
- 3: Confidence interval for the amount of returns for a product with high variability.

Figure 2.14. : Confidence intervals for products with similar expected amount of returns and different variability.

Source: Tibben-Limbke, R. S. (2002). Life after death: reverse logistics and the product life cycle. *International Journal of Physical Distribution & Logistics Management*. Vol. 32. No. 3. pp. 234.

A significant return volume is needed to justify the considerable costs of establishing a separate RL system, including the expense of a building, materials handling systems, information system and a large workforce. This is true even when returns management is outsourced to a 3PRLP. However, the variability in these returns is also a significant factor to consider when making strategic decisions in any RL system.

2.6.2.5. Outsourcing Strategy Factors For a RL System

When considering outsourcing decisions for RL, the fundamental factor to consider is whether there is a viable 3PRLP for the type of RL network required or not.

Outsourcing to a 3PRLP has been identified as one of the most important management strategies for RL networks in the recent years. In this vein, Meade and Sarkis (2002; 289) state three different choices that can be made with respect to the development of any RL function: to do nothing, develop an internal RL function, or find a 3PRLP and partner with them.

Even though there are several 3PRLPs in some of the business sectors, one of the most important issues in RL systems is that some of them (that are currently desiring to enter the RL service market) are not really prepared to effectively address these service needs due to the lack of knowledge of RL networks (Dowlatshahi, 2000; 151).

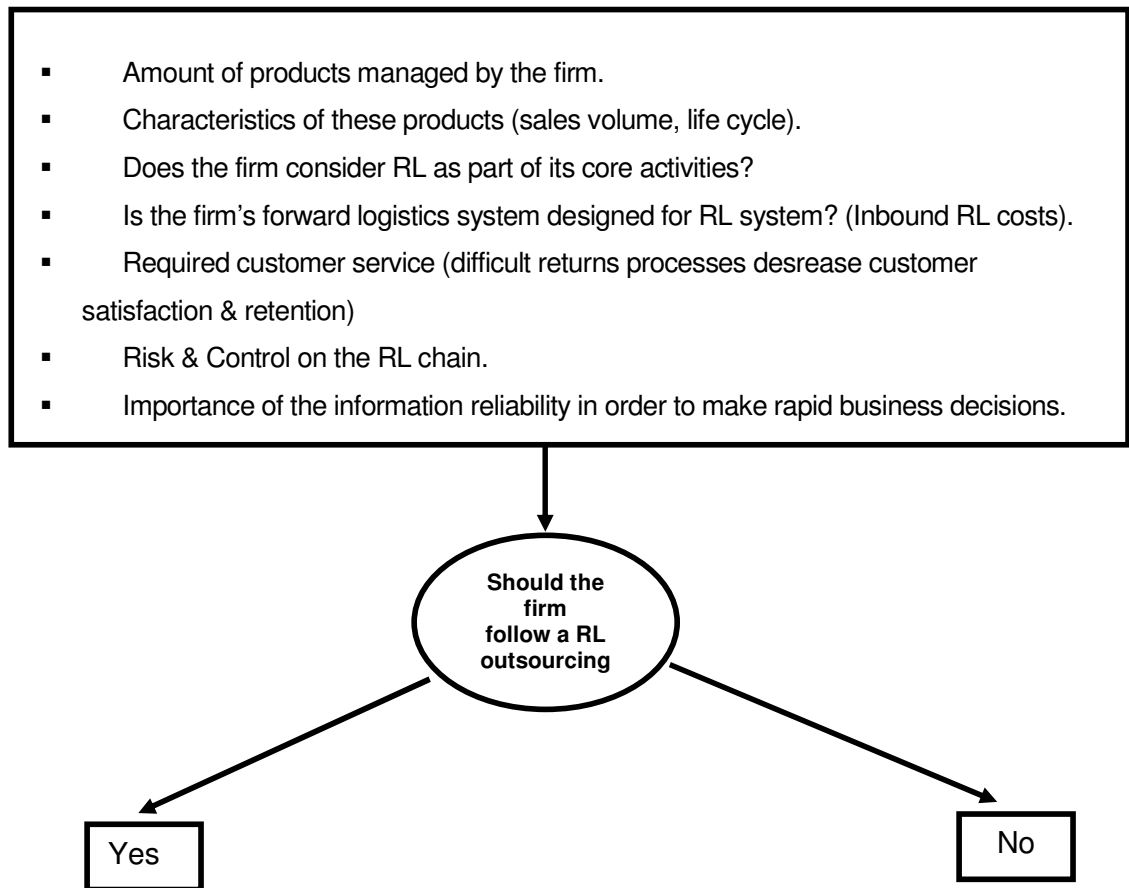


Figure 2.15. : The outsourcing decision process for a RL System

Source: Tibben-Limbke, R. S. (2002). Life after death: reverse logistics and the product life cycle. *International Journal of Physical Distribution & Logistics Management*. Vol. 32. No. 3. pp. 238.

As it can be identified in this figure, different elements need to be considered when an outsourcing strategy is going to be taken for a RL system. One of the most important issues is to define if the firm considers RL activities as part of its core

functions. When this is not the case, outsourcing might represent a good alternative in order to allow the firm to focus on its core activities.

Also, the cost of managing a returned item is one of the most important factors when choosing how to dispose of it, as well as the price to be received for it, if such a price exists. These factors will differ according to the scenario where the RL system can be classified. The relative importance these elements vary between companies, depending on its size, characteristics, products manufactured, manager's strategies and goals, etc. The amount of money invested in these activities will be a critical issue too.

If there is an extremely high variability in the rate of returns for the products managed in these RL systems, it is not economically feasible at all for a firm to develop its own RL facilities to deal with that flow, given that the amount of units to be returned will be significantly uncertain over time, and the required capacity will be changing constantly. The complexity of this situation increases when the life cycle for this type of products is extremely short, which requires quick but adequately decisions for these RL systems, in order to efficiently respond to such changing conditions. This can effectively be accomplished by involving a 3PRLP, which specializes in these activities, and can take advantage of the economies of scale to convert RL functions in a profit-creating activity into the closed-loop chain.

RL is a considerable improvement area for any firm when focused correctly. By considering two critical factors, the length of the product's life cycle and the variability in the amount of returns, a characterization of RL networks can be defined.

SECTION 3

APPLICATIONS IN THE DEFENSE INDUSTRY

There are multiple reverse logistics applications in the defense industry; some most of us don't even think about. For example; the buttons of uniforms yearly distributed to the soldiers are collected and reused if possible. This example doesn't require a sophisticated process from the reverse logistics perspective. This activity of collecting the buttons is done by means of the present distribution capabilities. But not all the reverse logistics activities are so simple. Unlike the other examples; there is a very sensitive and sophisticated issue to handle. This complicated issue is; evaluating the present stage of the ammunition in its life cycle depending on the storage conditions, deciding to modernize, remanufacture, recycle, dispose or resale it. Turkey is about to finalize a project equipped with the most modern tools and workshops, compatible with the EU environmental norms, for ammunitions to be modernized, remanufactured, recycled, disposed or resold to compensate the expenses in Defense Industry. This project was awarded by, NATO's executive branch about the logistics, NAMSA to a Turkish firm named Roketsan. This application section gives detailed information about the project and the results of it in the Defense Industry.

3.1. NORTH ATLANTIC TREATY ORGANIZATION (NATO)

Post-war political events in Europe led a number of countries to pave the way for the creation of the North Atlantic Treaty Organization (NATO) in 1949.

The North Atlantic Council is the supreme body within NATO and is composed of Ministers or Permanent Representatives from the 26 member nations. The NATO Secretary General is Chairman of the Council. He is supported by the International Staff Secretariat composed of staff drawn from all member countries.

There are a number of Committees which report to the Council. These are made up of experts from all member countries and they exist to advise the Council on specific matters such as political, economic, scientific, military, financial, budgetary and other subjects. The Military Committee (MC) is the highest military authority answerable to the Council and consists of Chiefs of Staff (Defence Chiefs) or their representatives from each

member country except France and Iceland. The Chairman of the Military committee has at his disposal the International Military Staff (NAMSA, 2007;1). Functions of the key bodies of NATO are as follows: (Brown, 2007)

1) North Atlantic Council (NAC) is Supreme decision-making body consisting of varying levels of representation from the member countries in which the decisions are taken by consensus.

2) Defence Planning Committee (DPC) acts in the name of the NAC and mainly focuses on defense matters.

3) MC is the highest military authority and subordinate to NAC/DPC and oversees Strategic Commands and specialized military agencies.

From the perspective of NATO; nations and NATO authorities have a collective responsibility for logistic support of NATO' s multinational operations. This collective responsibility encourages nations and NATO to cooperatively share the provision and use of logistic capabilities and resources to support the force effectively and efficiently. Standardization, cooperation and multinationality in logistics build together the basis for flexible and efficient use of logistic support thereby contributing to the operational success. NATO logistics has the principles of; collective responsibility, authority, primacy of operational requirements, cooperation, coordination, assured provision, sufficiency, efficiency, flexibility, visibility and transparency (MC 319/2, 2004; 4). In NATO logistics activities, effective supply and maintenance support is extensively executed by the NATO-wide main actor which is called NATO Maintenance and Supply Agency – in short NAMSA.

3.1.1. History And Organization of NAMSA

By 1958, 15 of NATO's member countries realized that effective supply and maintenance support for certain commonly-held items of material could best be provided through a centralized support facility.

Thus, the NATO Maintenance and Supply Organization (NAMSO) was created in 1958 as a subsidiary body of NATO and in compliance with the agreement on

the status of the NATO, national representatives and international staff including NATO nations with the exception of Canada and Iceland. But, later Canada joined NAMSO in 1975 as well The Czech Republic and Hungary in 1999 and Poland in 2000 (Ottawa Agreement, 1951).

The executive Agency of the Organization, the NAMSA, whose Headquarters was in Paris, operated mainly as a procurement activity and has the following history: (NAMSA, 2007;3)

In 1960, the NATO Supply Centre (NSC) was created at Châteauroux (France) as the first Operational Centre under NAMSA Headquarters' control.

In 1965 a second Operational Centre was activated for the procurement of spare parts for the F104 aircraft: the Koblenz Procurement Centre (KPC) in Koblenz (Germany).

Early in 1968, NAMSA Headquarters and the NSC were transferred from Paris and Châteauroux to the Grand Duchy of Luxembourg.

A third Operational Centre was activated in Taranto (Italy) in August 1972; namely the NAMSA Southern Depot (SD), now known as the Southern Operational Centre (SOC), to hold stocks of spare parts for the countries of the Southern Region and it is placed under the authority of the Director of Logistics Programmes and Operations.

The HAWK Logistics Management (HLM) located in Rueil-Malmaison (Paris) was created in January 1975 when the Agency took over full responsibility for HAWK logistic support with the exception of its supply branch which is located at Capellen. It is placed under the direct authority of the General Manager.

Finally, a NAMSA NIKE Training Centre (NNTC) was activated in 1980 at Fort Bliss, Texas (USA) to train personnel responsible for maintaining the NIKE HERCULES missile system in its European configuration. Having completed its mission, the NNTC ceased operations at the end of 1986.

In short, NAMSA's main facilities and the majority of its workforce of around 950 are located at Capellen in the Grand Duchy of Luxembourg. The Southern Operational Centre in Taranto, Italy, serves mainly AFSOUTH nations, and NAMSA's HAWK Logistics Management office near Paris supports the HAWK weapon system.

3.1.2. Structure of NAMSO's Main Elements

NAMSO Board of Directors - composed of representatives of the Organization's current 26 member countries - which ensures that individual national interests are taken into account also responsible for general policy decisions and the issuing of directives to enable the Agency to carry out its mission. Besides, a number of support agreements are in place with some Partnership for Peace (PfP) nations.

The NAMSO Board of Directors is assisted by two Subsidiary Committees: the Finance & Administration Committee and the Logistics Committee, whose role is to study the problems and proposals raised by the Agency and to make recommendations to the Board. The NAMSO Board of Directors and the two Subsidiary Committees have the same Chairman.

NAMSA is the executive arm, headed by the General Manager and comprising:

NAMSA Headquarters (HQ) located in Capellen and consisting of the staff of the General Manager and four Directorates, viz. Resources, Finance, Logistics Programmes & Operations and Procurement. Each director is answerable to the General Manager as regards Agency activities falling within his technical area of responsibility.

Programme Offices and Divisions are also located in Capellen. NAMSA's services are provided by its customer-oriented Programme Management Offices (PMO) and the above mentioned Procurement Division. Each PMO functions as a business unit supporting one or more weapon systems. This organization allows for a single point of contact for both customers and suppliers. At the heart of each PMO lies a Materiel Management Centre (MMC) staffed by logisticians, engineers and technicians plus collocated staff from the Procurement and Finance divisions. This collocation improves

internal communication and ensures efficient satisfaction of customer requirements. (NAMSA, 2007; 4).

Responsibility for all aspects of support provided by NAMSA in respect of each weapon system or electronic system is placed in the hands of a Programme Manager. This does not mean, however, that all the tasks are performed by the Programme Offices.

A number of specialized Divisions (Internal Audit, Linguistics Services, Quality Assurance, General Administration and Infrastructure, Organization and Process Improvement, Information Systems, Personnel, Finance, Transportation and Warehousing, Procurement) support the Programme Managers in the discharge of their functions, but all actions related to the support of a specific weapon system or electronic system are taken at the initiative and under the supervision and responsibility of the Programme Manager concerned.

3.1.3. Mission of NAMSA

As NATO's principal logistic support management agency, NAMSA's mission is to provide logistic services in peacetime as well as in wartime in support of weapon and equipment systems held in common by NATO nations, the aim being to promote materiel readiness, to improve the efficiency of logistics operations and to effect substantial savings through consolidation of procurement.

To accomplish this mission, NAMSA exercises the powers and responsibilities with which it has been vested in the areas of spares supply, equipment maintenance, calibration, procurement, warehousing and transportation, engineering and technical support services, contract management and configuration management for some 50 air, land and sea weapon and equipment systems with more projects in the development stage. Other activities include codification/identification services (with an international electronic mailbox system handling more than 500,000 transactions per month) demilitarization (including activities funded by the PfP trust fund) and arranging contracts for the disposal of all types of ammunition (NAMSA, 2007a; 12). Last two will be our main focus and concern.

Most of these services are outsourced to industry and the Agency's main role is consolidating nations' requirements, centralizing logistics management activities, conducting international competitive bidding processes and controlling the cost and quality of the services provided. NAMSA brings customers and suppliers together, promoting long-term mutual benefits.

NATO nations are not obliged to use NAMSA for the support of their military equipment. However, where a collaborative approach with other members of the Alliance proves to be more cost-effective than individual nations supporting their equipment independently, it is in their interests to do so.

A number of NAMSO's staff are deployed to theatres like Balkans, Afghanistan, Kuwait and Iraq and to some NATO commands to provide first-line support to operations.

3.1.4. Services by NAMSA

The services executed by NAMSA are mainly; procurement, continuous supply of spares, maintenance requirements procured equipments, warehousing and transportation, engineering and technical support, , contract management, random brokerage, repair services, port services, calibration, electro-optics and in the concern of this study the most imported, rapidly changing according to the environmental constraints and norms and the most recent popular one which is demilitarization. In NAMSA's Operational Support Strategy there is a program called "Operational Logistics Support" and under this program ammunition support is maintained in the following ways:

- 1) Ammunition Procurement
- 2) NATO Ammunition Database
- 3) PfP Trust Fund Projects
- 4) Ammunition Demilitarization

Ammunition Procurement is of the ammunition related services of the program by means of NATO Ammunition Database. Main data sources of this software are Nato Codification System including more than 255,000 ammunition items, Allied Publications

including more than 400 ammunition-related publications such as Standardized Agreements (Stanag), Agreement of Procedures (AOP) and subscriptions of NATO and Non-NATO countries.

As mentioned before; PfP Trust Fund Projects are for mainly the PfP countries of the former Soviet Union located in Central Asia having huge quantities of excess ammunitions, ammunition production facilities and other strategic industries, inherited large quantities of arms and ammunition remaining from the end of the Cold War.

NATO PfP activities are sponsored by member nations through the NATO PfP Trust Fund, which was initially established in 2000 by the Political Military Steering Committee (PMSC) of the Euro-Atlantic Partnership Council (EAPC), as a mechanism to enable partner nations to meet their Ottawa Convention Obligations to dispose of anti-personnel landmines. That year it has been expanded to address the disposal requirements of small arms and light weapons, which pose particular security risks associated with arms trafficking and, in principle, all conventional munitions.

NAMSA has been selected as the Agency of choice to examine the technical, operational and financial viability of any project proposed by the partner country and to create a suitable project proposal. NAMSA also manages all aspects of any subsequent project, ensuring that the project achieves its operational aims within budget, on time and with full transparency to all parties.

The first project to be implemented enabled the Albanian government to destroy 1.6 million stockpiled anti-personnel mines. The project necessitated the refurbishment of process buildings, equipment and other facilities at the former munitions factory at ULP Mjekes in central Albania. The project was successfully completed in April 2002. In addition to the operational success it provided socio-economic benefits through the creation of some 70 jobs within the factory and resulted in the recycling of 192 tonnes of TNT and 1,100 tonnes of ferrous materials for civil purposes.

There are some expedient and industrial solutions to execute demilitarization techniques. Expedient solutions are; sale or gift, rapid firing, open burning and open detonating. Industrial solutions are; disassembly, melt-out, wash-out, reclamation and

conversion, cryogenics and incineration. In this special area of operation NAMSA has an unrivalled expertise to develop proposals to suit customers' needs, to prepare contracts and to manage demilitarization projects. All of these experience are revealed to the last project stationed to Turkey and named Ammunition Disassembly and Shell Facility (ADSF) under the Turkish Ammunition Improvement and Renovation Center (TARIDSC) institution.

3.2. TURKISH AMMUNITION RENOVATION, IMPROVEMENT, DISASSEMBLY AND SHELL CENTER (TARIDSC)

3.2.1. Mission of TARIDSC

TARIDSC's mission is to execute the examination, investigation and research activities of prohibited ammunition, to test them with the available tests in the laboratories and to study on the types of processes that should be applied to those banned ammunition. To be more precise; discovering the systematic ammunition failures on the army bases, execution of life extension activities and improving problem solving methods related to any kind of ammunition in the inventory of the army are ultimate goals of TARIDSC.

3.2.2. Modernization and Resettlement of TARIDSC

Heavy weapon ammunition, improved classic ammunition, rocket and missile systems are out of TARIDSC's capabilities which set the main problem areas. As of now, TARIDSC is able to solve the %20 of problems with the capabilities on hand.

Under these circumstances; since TARIDSC's means are very limited, most of the ammunition tests are done by the contracting firms in their facilities such as Mkek, Aselsan, Roketsan etc. Naturally this situation causes to be far from the objectivity and increases the dependency to contractor, which is outsourcing in a way, and is not a preferred situation in the defense industry especially for a vital means of war –the ammunition.

In most of the leading European countries in this sector; like Germany, Netherlands, France all the tests and studies are done in the facilities free from the manufacturer firms' control to be more precise.

In addition to these realities about the present situation, there are also some serious problems about the settlement of the present settlement of the facility. The present facilities of TARIDSC are in the civilian settlement anymore, so the current activities are limited and troubled. The ammunition tests done in this current area causes noisy explosions and disturbs the inhabitants. Besides, blast effect of these explosions brings the higher risk together for the inhabitants.

Moreover, another important and unignorable issue is security. Since the present settlement of TARIDSC is in the civilian settlement, it is very fragile against the raid and sabotage activities. In short, TARIDSC is in the preparation of changing its settlement and moreover in an investment preparation to fundamentally modernize and improve all facilities and capabilities.

With the present capabilities of TARIDSC; gunpowder test, body test, crack test and corrosion tests of the rocket, missile, modern artillery ammunition and classic ammunition in the inventory are possible. As mentioned before, these capabilities only meet the %20 of forces (land, navy, air and gerdarmerie) inventory needs which is very below the required level.

3.2.3. Present Capabilities of TARIDSC

In the concern of life extension process; some capabilities such as; life extension of Milan F1 missile, converting Milan F1 missile in to a F2 and F2 to F2A (2T) model is possible and illustrated below at figure 3.1.



Figure 3.1.: Present Capabilities of TARIDSC

1) Every 2 year, the stinger missiles in the Turkish Armed Forces (TAF) inventory are tested functionally by the NAMSA sponsored committee and those diagnosed as defective are not repaired by TARIDSC, but only in the coordination of TARIDSC. (Since TARIDSC is not able to repair them with its domestic capabilities unfortunately).

2) To describe and justify the reasons for prohibiting the ammunition, already in the inventory from using and guiding the successive procedures (such as; disassembly, shell etc.) that should be followed in the Ammunition Application Order of Turkish General Staff (TGS).

3) For profit maximization of the return ammunition, to investigate and improve new methods for the optimum use of any kind of ammunition which cannot be processed in any way.

4) In the Chemistry Laboratories; in addition to chemical analysis of any kind of gunpowder, driving cartridge and explosive substances, Metil Viyol Test, Moisture and Volatile Substance Designation Activities shown at figure 3.2. are possible. Also, any kind of ammunition and gunpowder produced by MKEK can be evaluated, however foreign

originated ammunition and gunpowder without test criteria can only be analysed and results can be compared with mathematical means.



Figure 3.2.: Metil Viyol Test, Moisture and Volatile Substance Designation Test in the chemistry laboratories.

5) In the Physics Laboratories; Leak-Proof Testing between the body and the cartridge of the light weapon ammunition, Metal Hardness Measurement Test of the ammunition, Mercury Nitrate Test, and examination of the surface of light weapon ammunition with the help of Surface Examination Microscope capabilities shown at figure 3.3. and 3.4. are possible.



Figure 3.3.: Leak-proof and Metal Hardness Measurement Tests in the physics laboratories.



Figure 3.4.: Mercury Nitrate Test and Surface Examination Microscope in the physics laboratories.

6) In the Corozion Laboratories; ammunition are tested to resist against corozion and special substances are tried and studied to prevent corozion on the ammunition which are shown at figure 3.5.



Figure 3.5.: Resistance to Corozion and Corozion Prevention Tests in the Corosion Laboratories

7) In the Destruction Diagnosis Laboratories; seasonal cracks that can take place on the surface of cartridge and at the connection points between the body and the cartridge of the light weapon ammunition can be identified with the help of special fluids. Cracks on the fuse mechanism and ammunition body, TNT vacuum and dislocated ammunition and also all the ammunition including 203 mm caliber are filmed with the help of XRAY capabilities and results are evaluvated which are shown at figure 3.6.

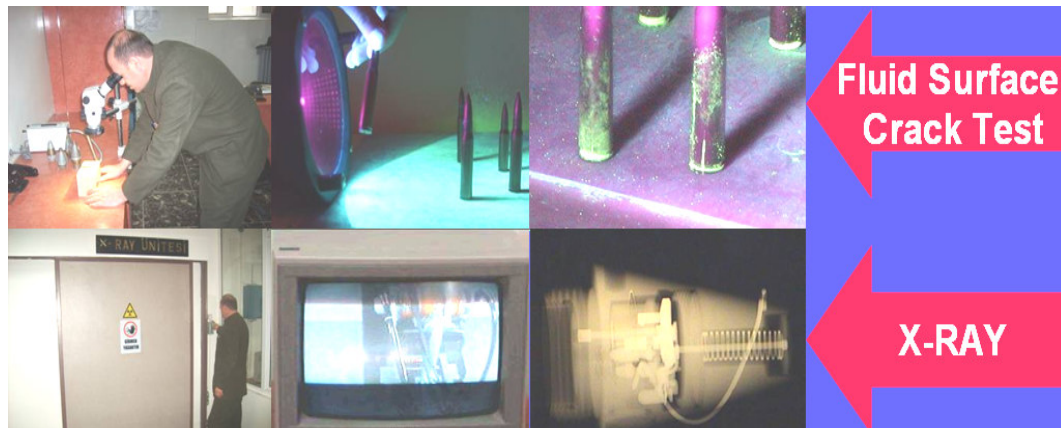


Figure 3.6.: Fluid Surface Crack and X-RAY Tests in the Destruction Diagnosis Laboratories

8) In the Improvement Workshop shown at figure 3.7.; all the prohibited ammunition and those requested to be examined in the forces (army, navy, air, gendarmerie) inventory are examined for the availability of dismantle process and those are decided to be improved are done.



Figure 3.7.: Examination for Dismantle or Improvement Process in the Improvement Workshop

3.2.4. Weaknesses of the TARIDSC

1) One of the main handicaps for the ammunition is determining the life cycle stage. The stage of the ammunition, already in the inventory, in life cycle process can only be traced by the firing results of the related unit. It could be also noticed that as of now; there is a large stockpile of prohibited and restricted ammunition in the inventory.

2) Since the rest of the life span of the stored ammunition cannot be calculated in advance, it has a great probability and potential to come across with the defected ammunition during any exercise or training. Naturally, as a result mainly personnel casualties, material, rifle and weapon damage or complete loss is possible. Moreover, the expected results seem impossible at the targets. This is a disadvantage from many aspects such as; morale, time, money and image in international exercises.

3) The present situation lacks the updated feedback capability to notify into the procurement technic contracts and worse lacks the detailed background information and ongoing processes about the ammunition entering the inventory at different times.

4) The amount of ammunition in the inventory on hand is known but on the other hand, the number of ammunition which has the required characteristics and its real performance is not known without a well-designed database.

3.2.5. Capabilities To Be Gained With The New Project

1) After the implementation of new proposed structure and process all the activities towards improvement, renovation, life extension and dispose of any kind of ammunition in the inventory will be studied in a more efficient and effective way.

2) All the ammunition, which are prohibited from firing and defined as defected, will be able to be examined in the furnished laboratories and test firing capabilities will be possible. After these processes the optimum ultimate decision for acceptance limit to use, suitability for use, modification, improvement or dispose will be given more precisely and objectively.

3) Ammunition database will be implemented and any kind of detailed information will be stored for any kind of ammunition, explosive substance, rocket and missile systems which is crucial for detailed statistical knowledge and traceability.

4) With the samples taken from any kind of ammunition in the inventory; different geographic condition specifications (such as; humidity, temperature, pressure etc.) of Turkey's sorted regions will be simulated in the laboratory conditions to specify better store and use conditions before its expiry date, so it can be send to any place on time where needed for spesific and immediate use.

5) With this gained capability and software feedback; life cycle extention of any ammunition planned to be procured will be possible and this crucial information will be notified into ammunition procurement technic contracts in the most updated form whenever needed.

3.3. AMMUNITION DISASSEMBLY AND SHELL FACILITY (ADSF)

Second step of the project is founding a completely new facility mainly for disassembly and shell processes. The project of ADSF was initiated at the end of year 1998 by Turkish General Staff (TGS) with the purpose of disposing of any kind of ammunition in the Turkish Armed Forces inventory both in the most economic way and in the best possible environmental concerns.

Project was planned under the the coordination of National Ministry of Defense, in the responsibility of TSG and with the participation of all Forces (Land, Navy, Air) Commands including Gendarmerie Command.

After the detailed examinations and evaluations of this project group this facility equipment and buildings were decided to award and contract to a national firm under the coordination of NAMSA, to be decised by TGS finally.

As planned; the awarding was done by the NAMSA and resulted with the winner firm named Roketsan at the end of year 2005. In the middle of year 2006 constructions begin and the project was planned to be completed and begin to perform its mission by the end of

year 2007. Project was consisting of four phases. These echolons in the draft can be counted as; draft sheme and improvement, construction and equipment, entegration and implementation and lastly acceptance and handing over.

Before going any further in the project, some required specifications are defined for the first step. In the draft scheme and improvement process main concerns were; profit maximization with reverse logistics process. To pave the way for this ultimate purpose; the most optimum settlement to minimize the ammunition transfer in the facility area, quantity versus distance harmony with the help of Ammunition Management Control Software, minimization of the personnal expenses and security issues by means of effective and controled project management with the help of automation, to give possibility to increase the capacity with the maximum modularity, minimization of number of constructions and would be builded according to regulations of The Ministry of Public Works and Settlement. Under these circumstances; main concern was national production with domestic sources and complete designation by Turkish engineers.

In this projected facility 52 different types and different calibers ammunition reaching the number of 40.000 tone of land, navy and air force including Gendarmerie Command were planned to be disassembled and shelled. Besides yearly, 6,000 tone of ammunition disassembly and shell process is proposed.

The most important aspect to take in to consideration about the facility was; it would be builded and certified according to NATO ciriteria espacially in the concern of safety, security and enviromental concerns.

3.3.1. Specifications of the Facility

The facility would consist of two main parts: First part is Administrative Service Facilities and the second part would be consisting of Storages and Workshops. The perimeter of the all facility would be enclosed with a wire fence and perimeter enlightenment in the concern of security issue. Fire hydrants and pressure tank would be prepared in case of fire. Waste water purification system will be implemented. In case of energy interruption, diesel jenerator and uninterrupted power source would be provided. Settlement of the ADSF facility is illustrated below at figure 3.8. for the general picture:

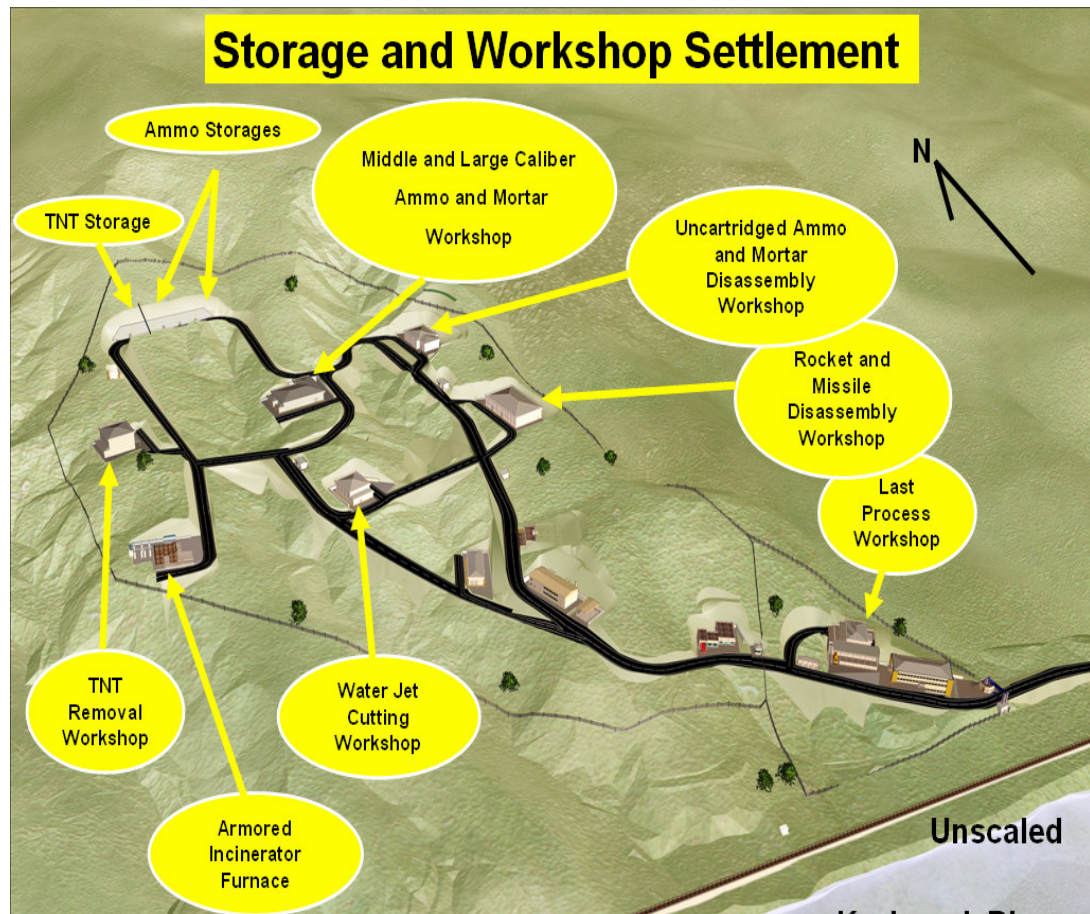


Figure 3.8.: Settlement of the ADSF Facility

3.3.2. Storage and Workshops

In the storages the ammunition taken from the units to disassembly and shell processes will be stored. Two storages having the 340 m2 capacity with a three tones of ceiling cranes are planned for this activity. Ammunition trunks will be weighted and barcoded before taken into storages. Any diminishing in the weight or loss will be easily determined and informed by the Ammunition Management Control Software database. For the steady and continious fluency of sorted ammunition (shown at figure 3.9.) from the storages to the workshops depending on the type and process to be applied (disassembly and shell processes) Administrative Control And Management Software will be used.



Figure 3.9.: Ammunition Types for Disassemble and Shell Processes

3.3.3. Middle and Large Caliber Complete Rounds And Mines Workshop

In the workshop the shelled ammunition (shown at figure 3.10.) having the calibers between 40-120 mm, and all the mines having maximum calibre of 250 mm will be disassembled. The workshop will be consisting of 3 lines which are;

- 1) Disassembly line of ammunition with the spillable gun powder,
- 2) Disassembly line of bagged ammunition,
- 3) Disassembly line of Mines.

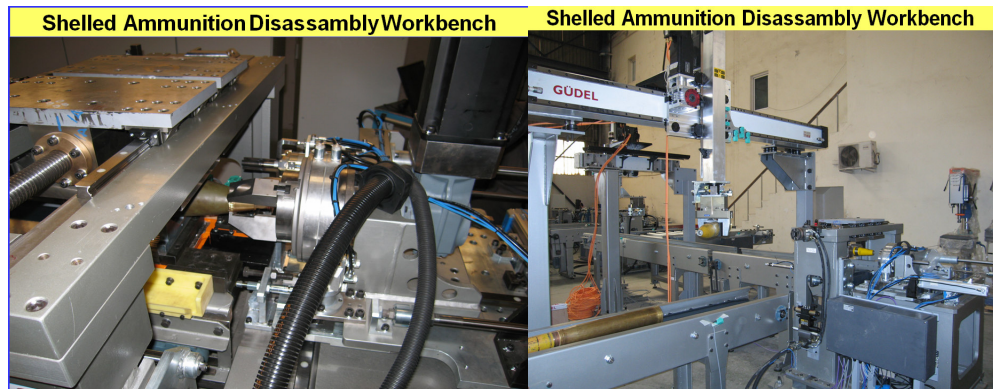


Figure 3.10.: Shelled Ammunition Disassembly Workbench

In first two lines since the types resemble to each other process is common and following steps are applied;

- a) Ammunition are taken out of the trunks,
- b) Fuse and cartridge is disassembled from the body,
- c) Bodies are dispatched to the TNT removal workshop,
- d) Gunpowder is evacuated from the cartridge and weighted,
- e) Cartridge capsule is exploted in the explosion workbench (shown at

figure 3.11.).

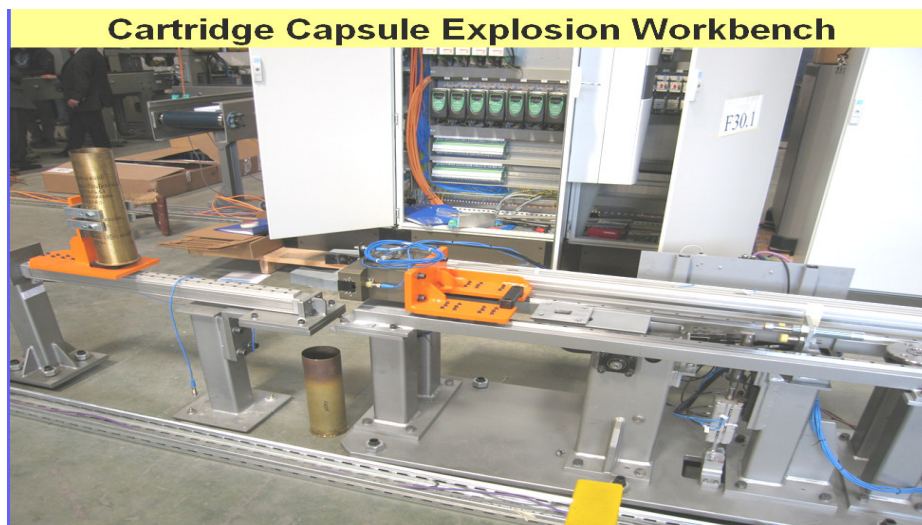


Figure 3.11.: Cartridge Capsule Explosion Workbench

Even if the third line is only for mines which is completely a different type of ammunition, the process looks like almost the same;

- a) Mines are taken out from the trunk,
- b) Mine covers are dismantled and opened,
- c) And mines are dispatched to the TNT removal workshop.

Workshop equipment consists of; fuse disassemble unit (shown at figure 3.12.), drag and separation unit, gunpowder discharge unit, weighting unit, capsule explosion unit, conveyor system and some supportive equipment.



Figure 3.12.: Fuse Disassemble Units of Different Mines

Some ammunition types and estimated figures which are planned to be exposed to this process are as follows:

- 1) From the land forces inventory, 105 mm howitzer ammunition 125,000 units and 30*602 tank artillery ammunition about 3,500 units.
- 2) From the air forces inventory, 40 mm antiaircraft ammunition about 70,000 units.
- 3) From the navy inventory, 40-56 mm navy artillery ammunition about 130,000 units.
- 4) Some anti personnel mines such as; M2, M2A4, M3, M14, M67, DM11 about 2,500,000 units.
- 5) Some anti-tank mines such as; M6A2, M7A2, M15, M73 about 200,000 units.

3.3.4. Uncartridged Ammunition And Mortar Disassemble Workshop

In the workshop; different size of uncartridged, blind fused and unbased-catridged ammunition between 100-125 mm and mortars between 40 mm-120 mm are planned to be disassembled. The workshop consists of three different lines:

- 1) Semifixed ammunition disassembly line,
- 2) Blind-fused and unbased-catridged ammunition/fuse disassembly line,
- 3) Mortar disassembly line.

1) In the semifixed ammunition disassembly line;

- a) Ammunition are taken out from the trunk,
- b) Fuses are separated from the body,
- c) And bodies are dispatced to the TNT removal workshop.

2) In the Blind-fused and unbased-catridged ammunition disassembly line (shown at figure 3.13.) in addition to the previous three steps;

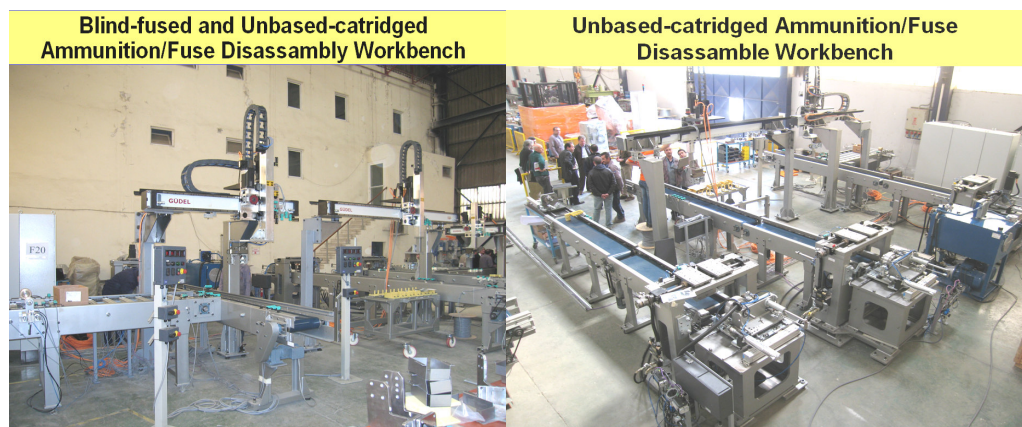


Figure 3.13.: Blind-Fused And Unbased-Catridged Ammunition Disassambly Line

- a) Gunpowder is discharged from the catridge and weighted,
- b) Lastly cartridge capsule is exploted.

- 3) In the mortar disassembly line;
 - a) Ammunition are taken out from the trunk,
 - b) Tail section is pulled apart and driving gunpowder is discharged,
 - c) Fuses and tail sections are completely separated from the body,
 - d) And the bodies are dispatched to the TNT removal workshop.

Equipments of this uncartridged ammunition and mortar disassemble workshop are; blind fuse dismantle unit, fuse and tail dismantle unit, gunpowder removal unit, weighting unit, capsule explosion unit, conveyer belt and some supportive equipment.

Some ammunition types and estimated figures which are planned to be exposed to this process are as follows: From the land forces inventory;

- 1) 15 cm howitzer ammunition about 200,000 units,
- 2) 23 cm howitzer ammunition about 150,000 units,
- 3) 60 and 81 mm mortar ammunition about 160,000 units.

3.3.5. Rocket And Missile Disassembly Workshop

In this workshop missiles and big rockets having various calibres 200 through 600 mm and small rockets having various calibres 60 through 130 mm are disassembled. The workshop will be consisting of two lines which are;

- 1) Missile and large rocket disassembly line,
- 2) Small – dimensioned rocket disassembly line.

In the first line for missiles and large rockets the following steps are gone through;

- a) Dismantling of war head, fuse and motor parts,
- b) Dispatching the body to the TNT removal workshop,
- c) Dispatching of war head, fuse and motor to the last process workshop.

In the second line which is for small – dimensioned rockets disassembly process includes the the following steps which are almost common but differs only because of the technic structure of the ammunition;

- a) Dismantling of war head, tail and motor parts,
- b) Dismantling of bottom fuse from the body,
- c) Dispatching of body to TNT removal workshop,
- d) Dispatching of war head, fuse, motor and tail section to the last process workshop.

Workshop equipment consists of; fuse, blind fuse dissamble unit; motor, war-head dissamble unit; motor, tail section dissamble unit; drill dissamble unit; conveyor system and some other supportive equipment.

Some ammunition types and estimated figures which are planned to be exposed to this process are as follows: From the land forces inventory;

- 1) From the land forces inventory; 3,5 inch rocket about 65.000 units.
- 2) From the air forces inventory; AN-M81 about 1500 units, Rapier MK-1 about 300 units.
- 3) From the navy inventory; MK7 Water Bomb about 400 units, MK9 Mod 4 Water Bomb about 900 units.

3.3.6. Water - Jet Cutting Workshop

Ammunition which cannot be dismantled safely will be cut into pieces in the water jet workshop. Besides unsafed ammunition, high-volumed and big ammunition will be cut by the water jet to form them into appropriate dimensions to be able put them into TNT Discharge Unit and Armored Waste Incineration Furnace. Workshop equipment consists of; radial water jet cutting equipment, axial water jet cutting equipment, band saw jet cutting equipment.

3.3.7. TNT Removal Workshop

In this workshop mainly; TNT and similiar explosives in the ammunition body are removed by means of melting process in the autoklaves (shown at figure 3.14.). These obtained explosives are crystalized at a specific purity for the optimum reuse option. After these processes the rest of the ammunition, which can not be used in any way, will be formed into appropriate dimensions for waste incineration in the Workshop. Workshop equipment consists of; autoklave apparatus, mixer couldran figure 3.15.), cristalization unit, water coolent, TNT block shaping unit and some other supportive equipment.



Figure 3.14.: Melting Cauldrons

TNT Mixer Cauldrons (2 Units)



Figure 3.15.: TNT Mixer Cauldrons

3.3.8. TNT Storage

TNT Storage will be used to store the TNT and TNT like explosive substances removed from the bodies of ammunition in TNT Removal Workshop.

3.3.9. Armored Incinerator Furnace Workshop

The workshop consists of two main units; Armored Waste Incinerator and Flash Firing Furnace with the capacity of 3.500 kg/hour. In the Armored Waste Incinerator (shown at figure 3.16.); various caliber of ammunition, fuse, tail, wing etc. up to 40mm coming from disassemble workshops and TNT left overs, mines and explosives are planned to be annihilated. On the other hand; Flash Firing Furnace (shown at figure 3.16.) will be used to get rid of the explosive left overs on the body and cartridge of the ammunition, in case it was skipped accidentally, before the last process. The capacity of armored incinerator furnace is shown in the table 3.1. below:

Table 3.1.: The Capacity of Armored Incinerator Furnace

Line No	Catridge / Explosive Type	Firing Capacity
1	7,62 mm	20,000 unit/hour
2	12,7 mm	6,000 unit/hour
3	20 mm / 30 mm	300 unit/hour
4	Strong Explosive	100 kg/hour

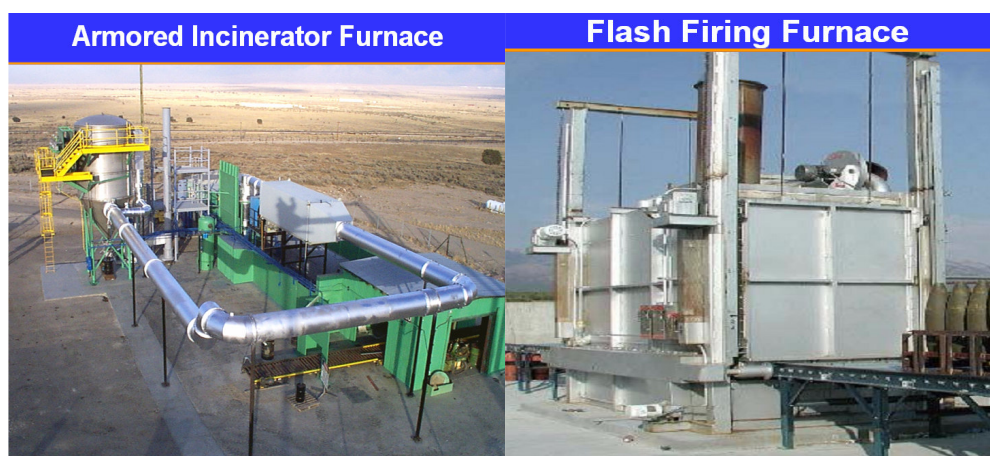


Figure 3.16.: Armored Incinerator Furnace and Flash Firing Furnace

3.3.10. Last Process Workshop

Last Process Workshop consists of two different units; driving encirclement cutting unit and press units. In the driving encirclement cutting unit (shown at figure 3.17.); high economic valued copper driving encirclements are processed for reuse. In the press units; original patern of leftover ammunition and all metal left overs are ruined by means of hidrolic press unit. Last process workshop equipment consists of; CNC Driving Encirclement Cutting Unit, Hydraulic Press Units, Conveyor system and some supportive equipment.

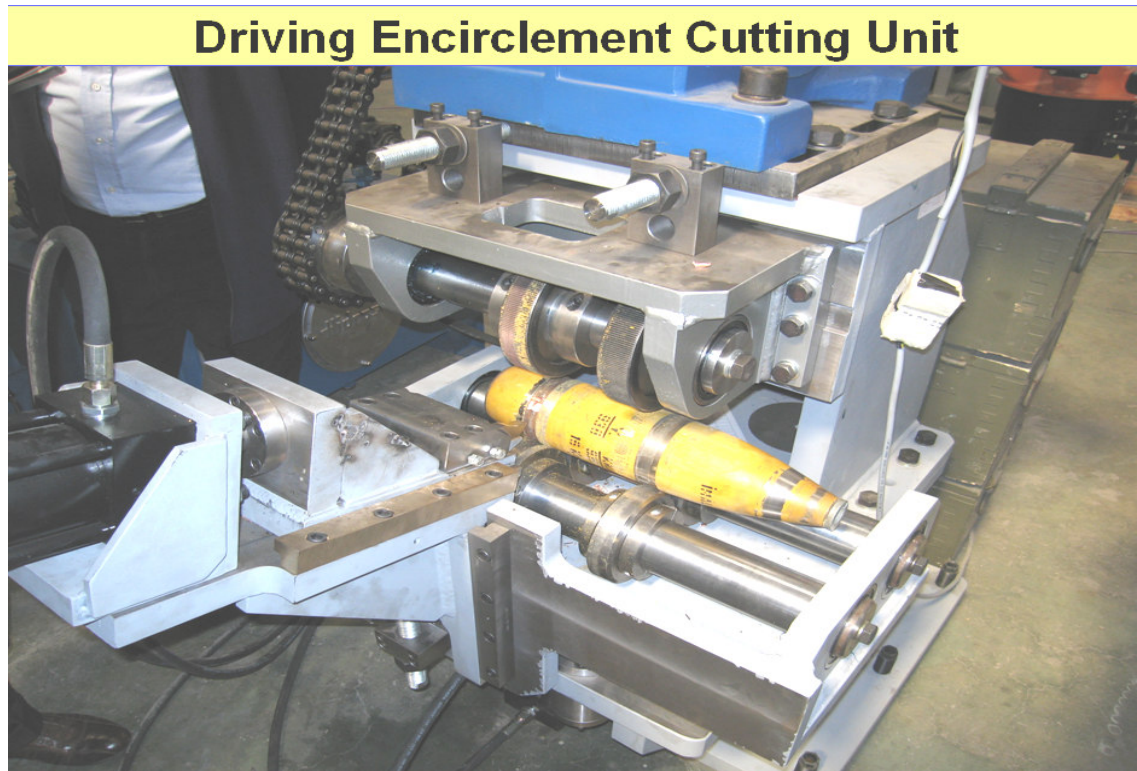


Figure 3.17.: Driving Encirclement Cutting Unit

3.3.11. Estimated Returned Earnings and Education Activities of ADSF

Estimated Returned Earnings from different materials after the disassembly and shell process can be summarized economically in some figures below at the table 3.2.:

Table 3.2.: Estimated Returned Earnings

Line No	Material Type	Amount (kg)
1	Steel	17,000,000
2	Aluminium	700
3	Copper	175,000
4	Brass	1,750,000
5	TNT	3,000,000

This ADSF was planned to be operated by a professional staff consisting of officers, non-commissioned officers (NCOs), civilian personnel and labourers to prevent the lack of professionalism. For this aim to come through parallel to ongoing project the following education activities were planned and begin to be executed listed at table 3.3. below:

Table 3.3.: Education Activities of ADSF

Education Subject	Participating Personnel	Education Period	Education Place
Basic Ammunition and Explosive Substances Education	- Officers - Non-Commissioned Officers - Civilian Personnel - Labourer	2 weeks	- Ammunition Command - Maintenance School Command
Recognition of Land Force Ammunition and Security Precautions Education	- Officers - Non-Commissioned Officers - Civilian Personnel - Labourer	1 weeks	Ammunition Command
Recognition of Air Force Ammunition and Security Precautions Education	- Officers - Non-Commissioned Officers - Civilian Personnel - Labourer	1 weeks	Ammunition Command
Recognition of Navy Force Ammunition and Security Precautions Education	Officers - Non-Commissioned Officers - Civilian Personnel - Labourer	1 weeks	Ammunition Command
Recognition of Ammunition Produced by MKEK	Officers - Non-Commissioned Officers - Civilian Personnel - Labourer	2 weeks	Mkek Facilities
Recognition of Ammunition Produced by ROKETSAN	Officers - Non-Commissioned Officers - Civilian Personnel - Labourer	2 weeks	Roketsan Facilities
Work Security, First Aid and Urgent Situation Education	Officers - Non-Commissioned Officers - Civilian Personnel - Labourer	2 weeks	Ammunition Command

Conventional wisdom holds that the flow of goods in a supply chain typically ends with the consumer. In reality, however, a number of supply chain functions occur after final distribution of the product to the consumer. Yet even waste disposal, probably the most basic post-consumer activity, is nowhere to be found on most supply chain flowcharts.

This situation especially in USA and Europe is changing, however, accelerated by growing consumer awareness of recycling coupled with more stringent federal, state, and local regulations on waste disposal. The overall trend is evident, for example, in the disposal regulations governing used motor oil, vehicle batteries, and tires. Increasingly, manufacturers and suppliers in these and other industries are being held responsible for their products once the consumer is done with them. In an effort to deal with this responsibility and the related supply chain complexity, many industries are beginning to build reusability into their products. And this, in turn, necessitates developing an infrastructure to handle post-distribution and post-consumption activities.

Within this evolving environment, many leading businesses now realize that a reverse logistics system, combined with source-reduction processes, can be used to gain competitive advantage. As they take responsibility for post-consumer waste, they are striving to generate revenue or achieve cost savings, or at a minimum, keep from losing money from regulatory compliance.

In this concern; businesses today have tremendous opportunities to control their destiny when it comes to waste disposal and management. Rather than be regulated into positions that may not be the most advantageous to the channel members, manufacturers and their customers can reengineer their businesses to better serve the ultimate consumers while reducing their own costs. Indeed, companies that take the lead in these efforts have the opportunity to create competitive advantage in the marketplace as consumers around the globe become more environmentally conscious.

If manufacturers do not take the lead in these efforts, then their customers or government agencies may dictate the solutions. If they don't make the necessary changes, moreover, their customers may take their business elsewhere. A regulatory and

environmental proactive market approach to reverse logistics is better from every perspective.

More and more industries are discovering that it pays to be proactive on environmental issues as opposed to passively waiting to be regulated into action. They've found that it makes good business sense to recycle and reuse their products after the consumer is done with them.

Recycle, resale and dispose options are opportunities of revenue generating in reverse logistics programs. Returned products may even be donated for tax and public relations benefits. When these other options have been exhausted, the company may choose or be forced via regulatory purposes to dispose of returned product. When this is the case, the primary principle for businesses is to dispose adequately at minimum cost. While regulatory controls are becoming more stringent on proper disposal of products, the cost of dispensing waste continues to rise.

In many countries the resources and institutions required for safe management, secure storage and responsible disposal are not available, and also this inadequacies in these areas can result in major problems for international and human security. In practice the vulnerability or lack of technical expertise and resources in many countries, imply that major international assistance programmes are required to address the problems.

Despite growing political awareness of the issue, to date the international response has been limited in terms of financial support to surplus ammunition and explosive stockpile destruction as a global issue. Even there has been some progress in much of the world, a huge disparity continues between needs and response.

Few projects or priorities have so far been developed that have primarily been justified in terms of public safety, human security or development. Additionally, in some commercial cases, ammunition has been selected purely for ease of destruction or the potential return on material recovery.

To enable large-scale ammunition destruction is often proposed at international conferences to develop a regional demilitarisation facility. Whilst this can appear to be an attractive concept for many important stakeholders, the political and technical challenges

can in practice be very great. While governments may agree in principle to the notion of a regional facility, in practice several states typically insist that the facility is located in their own country, leading to long delays.

The risks and costs of transportation need to be thoroughly taken into account, which may become complex for regional facilities. For example, the most efficient means of transporting ammunition and explosives is usually by rail. Therefore the effectiveness of the rail infrastructure and distance to travel will have a significant impact as to any regional demilitarisation facility location. For example, in South Eastern Europe, Turkey, Romania or Serbia would be preferred choices according to transportation requirements, for location of a Central or Eastern European regional facility.

Overall, in these and other regions, the scale of stocks of ammunition and explosive materials in each country probably mean that there are sufficient national economies of scale to justify establishing and maintaining a national demilitarisation capacity.

In this concern; TARIDSC facility would be projected to modernize and additionally Disassembly and Shell Facilities planned to be founded in Turkey. By the end of these projects; Turkey will be able to cope with one of the biggest challenge of Defense Industry, which is the large and growing stockpile of ammunition that have been designated for demilitarization within the environmental concerns.

CONCLUSION AND RECOMMENDATIONS

The emergence of the global economy and intensified competition have led many firms to recognize the importance of the effective logistics management. The effective usage of logistics systems will be one of the primary competitive advantageous driving force in the near future. Thus logistics is one of the key concepts with augmented importance in gaining competitive advantage.

While logistics principles are the same domestically and globally, operating environments are more complex and costly. Primary emphasis is on quick, accurate, efficient fulfillment of demand. However, there's another consideration that needs to be factored into the strategic equation which is called reverse logistics. Besides, ever growing concern for environmental problems, and pressure from the global competitive marketplace toward further improvement of customer service, have also been presenting industries with this new challenge of the development and management of effective reverse logistics processes.

Reverse logistics is the process of planning, implementing, and controlling the efficient, cost-effective flow of raw materials, in-process inventory, finished goods, and related information from the point of consumption to the point of origin for the purpose of recapturing value or proper disposal.

Reverse logistics is an excellent strategic source of value added revenues. Manufacturers, distributors and retailers are struggling with the reverse supply chain. Product returns handling is an important process of the supply chain that is not well handled. Economic pressures for corporate profits are forcing manufacturers and retailers to look very hard at cost controls. Reverse logistics is one of the few remaining opportunities that has not yet received much attention.

Traditional delivery-oriented logistics systems often don't provide comparable quality on returns since the reverse logistics flow is very different from forward flow of product. A reverse logistics flow is much more reactive, with much less visibility. Reverse logistics activities include; processing returned merchandise for reasons such as damage, seasonal, restock, salvage, recall, or excess inventory, recycling packaging materials and reusing

containers, reconditioning, remanufacturing and refurbishing products, obsolete equipment disposition, hazardous material programs, asset recovery and disposal.

For years, returned merchandise was generally viewed as a headache for both the seller and the buyer. But innovative thinking combined with a desire to find a profitable opportunity has put a lot more focus recently on reverse logistics. Reverse Logistics by its nature is a very complex and specialized area of any supply chain. No matter what the product is, how it is sold, or who the customers are, every company needs to focus on recovering the greatest value from returns. All of this while maintaining customer loyalty, controlling cost and harvesting information that helps reduce returns in the future.

Businesses today have tremendous opportunities to control their destiny when it comes to waste disposal and management. Rather than be regulated into positions that may not be the most advantageous to the channel members, manufacturers and their customers can reengineer their businesses to better serve the ultimate consumers while reducing their own costs. Indeed, companies that take the lead in these efforts have the opportunity to create competitive advantage in the marketplace as consumers around the globe become more environmentally conscious. So, a proactive approach to reverse logistics is better from every perspective, mainly environmental.

There are four main RL processes which are: Collection, Combined inspection/selection/sorting, Re-processing or Direct recovery, Redistribution. Among these processes; reprocessing includes: repair, refurbishing, remanufacturing/retrievals, recycling, incineration activities. And direct recovery includes: re-use, re-sale and redistribution activities.

Publication houses, Beverage industries, Heavy industries, Consumer goods industries, Pharmaceutical industries and Automobile industries are the main industries where RL plays an important role. Depending on the industry and processes to be executed in the different firms there are various strategies to be implemented. These strategies are: Collaboration in RL for competitiveness, Growth strategy and source-reduction strategies as part of a RL, Creating value through RL, Design of RL network, process reengineering to reduce cycle time and improve customer service quality through speed in RL and 3PLs service and characterization of RL networks for 3PLs.

One of the effective application areas of RL is Defense Industry. In this sector the subject becomes more sensitive including the security and secrecy issues more than business issues. All RL activities; collection, inspection, selection, sorting, repairing, refurbishing, remanufacturing, recycling, incineration, reuse, resale, redistribution have a great usage area on the ammunitions in defense industry.

There are some forceful reasons to focus on reverse logistics such as :

a. Returns as a Competitive Advantage : Returns have the potential to be one of the greatest untapped sources for increased revenue and customer loyalty.

b. Returns are not Just a Necessary Cost of Doing Business : The costs associated with returns are far from trivial when all of the hard and soft costs are calculated to determine true business impact.

c. The Traditional Liquidation of Returns Channels Are Slow, Inefficient and Costly : Products lose value at every step to final disposition in the return channel.

d. Returns Contain a Wealth of Information : Information about the original merchandising, actual product performance, ease of use, product defects, consumer expectations, consumers and products that few retailers and merchants capture.

e. Return Rates are Higher Than Ever, Especially the Growth of Online Retailing is Undeniable and inevitable : Return rates are and climbing, especially for online businesses which are experiencing increased return rates as a result of trial and impulse Internet purchasing. It is estimated that; e-Commerce will grow to \$247.8 billion, representing 8% of total retail sales by the end of year 2007.

f. The Cost of Returning Items to Vendors is Ultimately Absorbed by Retailers : Sending more products back to vendor's results in necessary price increases to their customers, the distributors and retailers.

g. Third Party Logistic Providers (3PLPs) Don't Handle Returns Efficiently : These providers have yet to develop the special processes or to make the incremental investments necessary to handle returns efficiently.

h. Customer Loyalty has Become Increasingly Rare : Firms may use their liberal return policies as a powerful way to attract and retain their customers.

i. Taking Full-Advantage of New Returns Technology is The Key: New technologies and service providers have emerged to address the increasing demand for better solutions in returns management.

j. Assets Utilization (Re-Utilization), Assets Recovery and Recycling has Great Importance Than Ever: Cost reduction and profit maximization through assets utilization (re-utilization), assets recovery and recycling has unignorable great importance than ever to capture the value, which otherwise will be lost.

k. Customer Relations Management is Increased : Customer Relations Management through after sales service and warranty is increased through fulfilling the environmental obligations, waste recycling, hazardous waste management and disposal.

Possible options for reclaimed product are; refurbish (improve product beyond original specification), recondition (return product to original specification), salvage (separate components for reuse), repair (prepare for sale as a used product), sell to 3rd Party, recycle, discard/liquidation (landfill) and dispose and main key incentives for reverse logistics are; customer retention/satisfaction, container reuse, recycling programs, damaged material returns, asset recovery/restock, downstream excess inventory (seasonality), hazardous material programs, obsolete equipment disposition, recalls.

This application study can be classified in Heavy Industry due to its relation with the Defence industry and one of its main concerns –ammunition-. But it is a completely special industry and requires special evaluation and treatment at all.

Stocks of thousands of tonnes of ammunition that are well beyond their shelf life are quite common globally. The sheer scale of ammunition stocks means that in many countries the resources and institutions required for safe management, secure storage and

responsible disposal are not available. The vast overall size of global stocks of ammunition is not widely appreciated.

There is little reliable information about the size of ammunition or other conventional ammunition stockpiles. Ammunition production and stocks are generally classified as secret for national security or commercial reasons. But information about ammunition stocks can raise greater sensitivity in armed forces, since it may relate to sustainability of military operations.

Over the past decade stocks of surplus ammunition in many countries have increased dramatically as a result of a reduction in the size of the armed forces. For example, the USA and its NATO allies maintain enormous stocks of ammunition, and have had to manage and dispose of millions of tonnes of surplus stocks since the end of the Cold War. However, in general these North American and European countries maintain relatively high standards of stockpile management and security, and have established industrial scale capacity for the safe destruction of their surplus stocks of ammunition. But, this is not the case in many other regions unfortunately. But, such ammunition stockpiling is of particular concern across much of other regions, including Africa, Latin America, South Asia, Central Asia, and East and South-East Europe.

The presence of explosives, toxic materials or propellants means that disposal or destruction of ammunition are relatively hazardous, and require much more detailed technical and expert response.

The principles and practices for high standards of management, security and disposal of ammunition stocks are widely agreed around the world. Some regional standards are widely acknowledged to represent best international practice such as NATO standards and the regional guidelines such as those established in the OSCE, SADC and by SEESAC are probably technically uncontroversial amongst expert practitioners in all regions.

In relation to disposal of all kinds of ammunitions there are several well established methods: sale or gift; increased use in training; deep sea dumping, or stockpile destruction.

However, the preferred and most effective option is the physical destruction of ammunition and explosives in terms of cost effectiveness, security and public confidence.

The physical destruction techniques available range from the relatively simple open burning (OB) and open detonation (OD) techniques to highly sophisticated industrial processes. The most appropriate destruction technique will depend primarily on: the resources available, the physical condition of the stockpile, the quantity of ammunition and explosives in terms of economies of scale, national capacities, and national explosive safety and environmental legislation. In general, the greater the amounts of ammunition to be destroyed, the larger are the economies of scale and therefore the wider range of affordable and efficient technologies.

Moreover, for large scale or on-going destruction programmes, it becomes more efficient to develop an industrial demilitarisation facility for the purpose. This requires time and substantial resources, including donor resources for many developing countries. This sort of facility requires infrastructure investment, staff training and demilitarisation equipment procurement.

There are multiple RL applications in the defense industry; but not all the RL activities are so simple. Unlike the other examples; there is a very sensitive and sophisticated issue to handle. This complicated issue is; evaluating the present stage of the ammunition in its life cycle depending on the storage conditions, deciding to modernize, remanufacture, recycle, dispose or resale it. Turkey is about to finalize a project equipped with the most modern tools and workshops, compatible with the EU environmental norms, for ammunitions to be modernized, remanufactured, recycled, disposed or resold to compensate the expenses in Defense Industry. This project was awarded by, NATO's executive branch about the logistics, NAMS to a Turkish firm named Roketsan. This application section gives detailed information about the project and the results of it in the Defense Industry.

Growing consumer awareness of recycling within the evolving environment coupled with more stringent state and local regulations on waste disposal necessitated Turkey to develop an infrastructure and a modern facility to meet post-distribution and post-consumption activities of ammunition in Defence Industry such as recycle, resale and

dispose options for the opportunities of revenue generating and even to contribute to the balance the huge disparity of the region continuing between the needs and response in this sector.

Like the other big actors of defense industry nations, one of Turkey's greatest challenge is to reduce the large and growing stockpile of ammunitions that have been designated for demilitarization.

Demilitarization processes consists of the modernization, reuse, destruction and disposing activities for any kind of ammunition including conventional ones also. Outright destruction of obsolete munitions increasingly is seen as wasteful, because many of them contain valuable materials that can be recycled. Recyclable materials in ammunition include bronze, iron, aluminum, aluminum alloy, brass, copper, copper alloy, propellants, lead, lead alloy, phosphorus bronze, stainless steel, steel, nickel, plastic, rubber, zinc alloy, wood, fiberglass, and even high explosives, explosive propellants, known in the industry as energetics, such as gunpowder and TNT. Some of the products and materials that result from the current demilitarization processes are also suitable for reuse. We call this a "source of supply" as it provides components for the production of new munitions.

The traditional way of disposing of munitions was by open burning or open detonation. Known as OB/OD, this method consists of burning or exploding old ammunition in open sites designated for the purpose. In recent years, however, OB/OD, which involves release of toxic fumes into the atmosphere, has come into conflict with increasingly strict environmental, health and safety regulations in the frame of EU adoption laws. Our focus now is to look for closed disposal methods (any method other than OB/OD) to not only comply with more stringent environmental guidance, but also recover and/or reuse any component with a justifiable value. Although quite effective and cost efficient, environmental compliance issues are forcing a change to closed disposal processes that are significantly more expensive. The emphasis on closed disposal has caused the government to make major investments in new processes for demilitarizing ammunitions. To highlight some of these emerging processes are; Disassembly, Removal, Resource Recovery and Recycling, and Disposal.

With this in mind, the Army in 2006 began to move away from open burning and detonation toward a program of resource recovery and recycling, known as “R3” or “R cubed”, as the primary way of disposing of ammunition. The R-cubed process takes ammunition (the resource), disassembles it, retains valuable components (recovery) and finds new uses for those parts (recycling). These conventional demilitarization activities will be conducted in the frame of the project in Turkey.

In this study it was aimed; to provide information about the scale and importance of ammunition issue in the Defence Industry, to describe demilitarization processes for different kinds of ammunition, to specify the principles of managing these processes, to describe demilitarization requirements during the execution of the processes, to characterize the demilitarization stockpile and specify the succeeding processes and to describe opportunities for recycling materials from the stockpile in this newly established facility. This most recent and most modern project was awarded by NAMSA and contracted to a Turkish Roketsan firm to be finished by the end of year 2007.

In this concern; Turkish Ammunition Renovation, Improvement, Disassembly and Shell Center (TARIDSC) facility was projected to get modernized and additionally Disassembly and Shell Facilities planned to be founded in Turkey. By the end of these projects; Turkey will be able to cope with one of the biggest challenge of Defense Industry, which is the large and growing stockpile of ammunition that have been designated for demilitarization within the environmental concerns.

The mission of TARIDSC, will be to achieve economies of scale in storage, demilitarization, disposal and transportation of all kinds of ammunition with the priority for the Turkish Armed Forces (TAF) military services and other potential foreign customers.

This facility will perform end of life cycle management for all kinds of ammunition, after they are transferred to the demilitarization stockpile when declared excess, obsolete or defective by the Military Services' Item Managers, to include disposition, demilitarization, and disposal with an emphasis on closed disposal including economically viable resource recovery and recycling for all TAF services. Further demilitarization researches and developments (R&D) to specify ammunition designs for demilitarization and to reduce ammunition total life cycle costs will be performed in this special facility also.

Primary goals of this facility will be as follows :

1. First of all; reduce the demilitarization stockpile in a closed disposal facility safely and within environmental concerns.
2. Implement resource recovery and recycling when economically viable.
3. Promote design for demilitarization as policy and requirement for all new or modified ammunition.
4. Match demilitarization execution infrastructure capability and capacity with execution requirements continuously.
5. Pursue, transition, and integrate R&D technologies that close capability gaps and increase cost effectiveness. Since there is such a wide variety of ammunition assembled using a variety of methodologies with a variety of explosive fills, the TARIDSC must explore numerous technologies to address complete demilitarization of ammunition items.
6. Enhance collaboration and communication within the demilitarization enterprise,
7. Strive for continuous improvement in all demilitarization enterprise activities.

Recommendations

a. Recommendations for the RL Process and Solution Proposals for Some Certain Problem Areas

Businesses have discovered that valuable commercial opportunities are embedded in reverse logistics and many are discovering that improving their reverse logistics processes can be a value-added proposition that may or may not have anything to do with environmental concerns.

Turning returns into revenue is a critical part of the RL business. While it's expensive to process the returns using a paper-based, uncoordinated system with few controls, the cost doesn't always show up in ways a company would immediately recognize, what happens is that reverse costs often exist in several different budgets, they will show up in other places that aren't normally associated with the return, including equipment usage, shipping costs, handling and labor costs.

The following elements may/should be implemented and should be taken into consideration in every RL process to increase its effectiveness and full capacity usage:

1) Implementing “Closed Loop” Approach : It is obvious that firms that develop reverse logistics programs relatively late compared to their competitors are at a disadvantage. This unignorable reality made some companies seriously considered a “closed loop” approach which is more than RL process. This process is integrating and merging of reverse and forward supply chains flows into one process, that includes product returns, service contract returns, product recalls, used equipment and replacement parts for refurbishment, as well as reuse, dispose off or sale as raw material. Significant customer service and financial benefits through the integration of inbound and outbound distribution activities will result in benefits with the combination of forward and reverse logistics together. Equipment, facilities and personnel can share both forward and reverse logistics activities, resulting in synergy in terms of reduced costs and improved service levels. In this frame, researchers should focus on the design of closed-loop supply chain. By this means, captured returns information should also easily be integrated with forward supply chain information to achieve optimum planning and reduction of costs. The type of design may vary depending on the types of products and needs of the customers.

2) Gatekeeping : The screening of defective and unwarranted returned merchandise at the entry point into the reverse logistics process, which is “gatekeeping”, should be implemented in various points in SC and should be used more effectively and functional.

3) Compacting Disposition Cycle Time : The amount of time needed to figure out what to do with returned products once they arrive is called “Disposition Cycle Time” and this time should be compacted and minimized. Often, when material comes back in to a distribution center, it is not clear whether the items are; defective, can be reused or refurbished, or need to be sent to a landfill. Faster return on investment capabilities should be implemented for shorter product life-cycles especially. Products with short product life-cycles lose their value more quickly. Thus, any delays in forward or reverse logistics that keep the items in the distribution system longer than necessary will result in some loss in product value. As products move into the mature or decline phases of their product life-cycles, prices tend to decline, causing margins to shrink.

4) Reverse Logistics Information and IT systems should be developed to handle reverse logistics and should be flexible enough for inevitable future expansion, as well as to have the ability to handle the many exceptions involved in reverse logistics. The reverse logistics system should create a database with the capability of tracking returns at the store level and back through the pipeline to the manufacturer. In this concern; communication gaps or misinformation occurrences should be minimized through implementing the most updated technology means. Otherwise physical product tends to fill in the gaps generally, uncertainties usually result in excessive safety stocks as a means for protecting the firm or supply chain.

5) Centralized Return Centers (CRCs) are the centers where customers send returns to be subsequently sorted, processed, and dispositioned and should be used more effectively for orderly and organized method of handling returns. RL structure should be reengineered and restructured in the best possible way not to skip important cost generating details. Most distribution facilities were not designed to handle reverse product flows, nor are personnel trained to effectively or efficiently decide whether to reship, repair, discard or return items to vendors/suppliers. In the RL process nature; pallets of returns do not resemble the neat and efficient stacks of new merchandise being shipped to customers. Usually, returns are placed in a more haphazard fashion on pallets and shrink-wrapped to maintain their integrity. Products being returned may not be in the same boxes in which they were shipped, so the use of bar-code reading devices may not be appropriate. Each item must be checked individually to determine its specific identity.

6) Implementing “Zero Returns” Program : Zero Returns is a program where the company in question does not accept returns from its customer. Rather, it gives the retailer an allowable return rate, and proposes guidelines as to the proper disposition of the items. This strategy basically passes the returns responsibility onto the retailer, while reducing costs for the manufacturer or distributor. Optimal Reverse logistics programmes should be developed primarily for uncontrollable returns. Because some of the controllable returns (for example, wrong product or quantity shipped, out-of-date products, damaged products) could be eliminated through improvements in product quality, better on-time delivery performance, or a reduction in shipping errors. Basically, good product quality and efficient logistics programmes on the forward side invariably reduce the number of returns on the reverse side.

7) Asset Recovery : Asset recovery is a process of classification and disposition of returned goods as surplus, obsolete, scrap, waste and excess material products and should be used in a way that maximizes returns to the owner, while minimizing costs and liabilities associated with the dispositions.

8) As of today, many companies should implement a strategy for properly managing used and obsolete goods and their components within regulatory guidelines. Because, this is critical to their post-sales supply chain to increase operational efficiencies and cost controls, as well as contribution to a safer environment.

9) With the proper strategies and metrics in place, reverse logistics should be part of the larger product and customer lifecycle strategies and can serve as a foundation for establishing customer loyalties and increasing market share.

10) Companies should capitalize on recyclers and other secondary markets to sell excess or obsolete equipment as well as byproducts of their production processes. Salvaged materials should be used as service inventory so that companies may be able to reduce their raw material costs through creative use of salvaged materials. And companies should continue to look for new opportunities as product lines and processes change.

11) A considerable power of market positioning of an effective returns management programs should not be skipped and ignored. As customers and consumers become increasingly conscious of the environmental impact of the corporations they deal with, reverse logistics activities can help a firm gain and increase customer loyalty. Many firms are finding that significant brand equity can accrue by being an environmentally responsible corporate citizen.

12) Even extensive research has been performed in relation to outsourcing logistics functions, not enough research has been made on the specific case of outsourcing RL activities. For further researchers, specific case of outsourcing RL activities and defining set of RL functions for selection of a 3PRLP will be a critical issue to search on.

13) Reverse logistics is and will continue to be a growing field and should be viewed as an integral part of the organization's overall supply chain.

Possible problem areas and recommendations for solutions in a typical RL process are follows:

P1 One significant area of conflict between a retailer and vendor is the warranty of returned products. Retailers are expected not to accept products returned to them beyond the warranty period. However, there are difficulties in screening defective and unwarranted products at the store level.

S1 Any product with a lapsed warranty should not be allowed into the reverse supply chain by retailers; such products consume time and effort in the reverse supply chain. For any product accepted close to the end of warranty may expire during this time delay. Verification of products at the store level may be done using invoices or serial number of product. However, this is easier said than done because tracking of millions of individual items requires maintaining a large database which proves inefficient, retrieval of information is time consuming and not cost effective. Information systems at the CRC should be responsive and raise exceptions and alerts to warn the retailer and expedite the returns process. The system should check if demand for this product exists elsewhere in the network of stores and accordingly arrange for movement of stocks.

P2 Another scenario for the expiry of warranty arises when a product awaits a RMA from the vendor at the CRC. The time delay between the product arriving at the CRC and being shipped to the vendor could be very high, due to delays in processing of the RMA, during which the warranty of products may expire.

S2 In order to reduce this delay the return process should allow raising RMA's at intervals depending on the product in question rather than a fixed time interval or awaiting an economic shipping quantity. For example; for products with a low shelf life RMA processing should be more frequent such that the product does not exhaust its shelf life in the return process. RMAs could be raised depending on near expiry items and independent of quantity of product being returned.

P3 The expiry of the warranty of a product after its return to the store, at any point in the supply chain raises issues of ownership leading to friction between various supply chain partners, especially between vendor and retailer.

S3 2D barcoding is a cost effective technology which if implemented will prove helpful in warranty tracking since it enables the availability of such critical information about the product like its description, serial number, date of manufacture, end date of warranty, price, shipping details etc. This enables the tracking of individual products even if it were produced in millions. Thereby, quick decisions regarding movement of products across the supply chain may be taken and reduce the losses due to out of warranty products.

P4 On returning a product, customers demand a reimbursement from the retailer. The retailer is obliged to pay the customer at the price at which the product was bought. However, customers may have misplaced or lost the invoice making it impossible to verify the price for reimbursement.

S4 Hence, it is important to be able to track the price of individual products while being returned by customers. Serial number tracking could be the answer to resolve this issue.

P5 Once the product is in the reverse supply chain and the retailer needs to return the product to the vendor an important question arises about the price that should be reimbursed to the retailer by the vendor.

S5 The price visibility is extremely significant due to the financial impact it has on the supply chain partners. Vendors and retailers should work on a returns policy which does not force either of them to change in price keeping in mind the customer retention.

P6 Customers expect reimbursement for the product returns almost immediately. They do not expect to wait endlessly for the confirmation on product returns between the retailer and vendor. The impact of this direct and timely response will increase customer service, customer loyalty and improve customer retention.

S6 Details like from which retailer the product was purchased, what was the price of purchase, serial number of the item etc. are important since it is the piece of information which links the item returned to the retailer to whom the product was sold as well as the customer who purchased it. The link can be established from the point-of-sale information.

P7 Most of the time products returned by customers to retailers or vendors are not in the original package. Either the package in which the product is returned is damaged or is of a different product all together. This creates problems in reverse logistics since any identification put on the product is lost and products are not in a position to be identified by any scanning media leading to a discontinuity in information flow in the supply chain. Besides, retailers may refuse to accept products not returned in the original packaging, this leads to friction between customers and retailers which ultimately results in an irate customer thereby affecting customer satisfaction, retention and loyalty and diminishing the brand equity of the retailer.

S7 Retailers should form a strict policy on returns of this kind. Vendors at the same time should resort to using technology that enables tracking of products in the supply chain even if the original packing is lost or destroyed. RFID is one technology which enables tracking of products since the RF tags are placed on the product directly and not on the package.

P8 Extremely high variability in the rate of returns for the products managed in the RL systems limits firms to develop their own economically feasible RL facilities to deal with the flow, given that the amount of units to be returned will be significantly uncertain over time, and the required capacity will be changing constantly. The complexity of this situation increases when the life cycle for this type of products is extremely short, which requires quick but adequately decisions for these RL systems, in order to efficiently respond to such changing conditions.

S8 This can effectively be accomplished by involving a 3PRLP, which specializes in these activities, and can take advantage of the economies of scale to convert RL functions in a profit-creating activity into the closed-loop chain.

b. Recommendations For The Defence Industry

It is apparent that we are in a surge due to excess ammunition reaching end of their designed shelf-life which will require timely disposal to avoid safety issues. It is not that difficult to imagine the expected total recyclable materials from excess ammunition with these major demilitarization efforts and its impact on the economy and future of the defense industry.

Legacy in demilitarization relied on Open Burn / Open Detonation. Closed disposal requirements and inflationary pressures will obviously cause an upward trend for the cost of demilitarization. Moreover, in the future, due to policy and regulations, demilitarization will require higher level of resource recovery and recycling and thus will be more expensive on a per-unit basis apparently.

Before FY07, proceeds from the sales of recycled (scrap) materials were returned to the National Treasury. After the activation of this facility, hopefully beginning in FY08, proceeds will be deposited into National Treasury Account to be used to support resource recovery and recycling programs.

After the activation and effective use of this premise, operational installations in the business and will be in the business will have an incentive to develop cost effective processes for the disposal of scrap both for themselves and the business also. This will be a major change in the business model that will intend to help address the funding shortfall for ammunitions demilitarization. In this concern; we will be looking forward to imerging inventive ideas on how to maximize return on our scrap.

Although the return of revenue from scrap sales will help our problem, it is not a complete solution. Beginning with the activation of the facility a very large-scaled advertisement attempt should be commenced to be known for the ongoing projects and available capabilities within the related industry in and out of the country. Any bilareral comminication will also ease the trade of experiences, inputs of innovative approaches for reduction of the demilitarization stockpile. To begin with, serious responses are expected coming from many of the domestic stakeholders (Roketsan, Havelsan, Aselsan etc.) in the current ammunition industry.

I believe the demilitarization stockpile has inherent value, and with the application of new and innovative approaches, we could increase the rate at which we dispose of these products. Depending on the ammunition to dispose of and statistics of the given units at stake in the region, the goal might be to reduce the stockpile by 10 % annually. Inputs from the ammunition community and innovative ideas to be received from different businesses are welcomed in this concern to increase the experienced information exchange in the sector. To be the first initiator in this brand new subject for Turkish Industry in the environmental concern companies and industry associations may develop groups and panels to address key reverse logistics topics including ammunition disposal.

Other than national enterprise, some international priorities and recommendations should also be defined to promote safe and secure management and destruction of all kinds of ammunition stocks, the international community needs urgently to prioritise the following actions:

a) Develop Specific Global Norms: Even if there is wide informal agreement amongst technically-expert practitioners across the world on international best practices and guidelines relating to safe and secure management and disposal of all kinds of ammunitions, specific international norms and standards on these issues need to be officially developed, and adopted at global level.

b) Identifying Priorities: While best international standards and practices need to be encouraged and adopted where possible, the scale and urgency of the problem priorities need to be set.

c) Developing an Adequate International Assistance Program: Measures are needed to develop a much larger and more coordinated international action programme in this area. In contrast to the present efforts, this needs to be widely supported, well-resourced, more institutionalised, and have mechanisms for information exchange, coordination, and emergency action.

d) International Information Exchange: Lack of official information relating to ammunition stocks has hampered efforts to tackle the problems. Specific national, regional and international mechanisms for information exchange are required to address this problem. Further research is also required.

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