Indian Journal of Economics and Business
Vol. 20 No. 3 (December, 2021)

http://www.ashwinanokha.com/IJEB.php

# Evaluation of reverse logistics options for international and local companies in Iraq

**Dr. Omar F. Hassan Al-obaidy* , Dr.Suha Jamal Mawlood & Dr. Mohammed Ibrahim Al-Dulaimi****

*Al-Rafidain University College - Department of Business Administration*

*University of Baghdad, College of Administration and Economics*

*Al-Rafidain University College - Department of Business Administration*

**Received:** 18th August 2021
**Revised:** 19th September 2021
**Accepted:** 08th October 2021

**Abstract:** Many international companies have branches or agencies in Iraq and have large market shares, and this has contributed to the increase in the import of these companies' products. This process created an additional problem of handling a large number of expired or defective products. There are many methods that contribute significantly to reducing these problems. The most prominent of these is the activation of reverse logistics options in Iraq by international and local companies. This research aims to conduct a survey of the reverse logistics options approved by some local and international companies and compare between them. This paper found that Amaron, Hitachi, Apple, Samsung and Huawei have limited options for reverse logistics and that these options do not contribute to solving the problem of waste accumulation, especially e-waste. In addition to the weakness of the governmental and supervisory role in this field. In contrast, local companies work on most of the options offered by reverse logistics.

**Keywords: Reverse Logistics, Iraqi Companies, Reverse Logistics Options, Circular Economy**.

## 1- Introduction:

Gradually, the return movement of goods and services in the supply chain became a necessary business activity, regardless of the industry, product or services involved. Overall, the value of returns is estimated at around $ 43 billion annually. This represents an average of 15% - 20% of all goods sold (Genchev, 2009: 139). However, supply chain management, due to the increasing competition in the market, made it imperative for companies to ensure the efficiency of their resources, increase the quality of their products and services, and reduce delivery and inventory time (Afra & Behnamian, 2021: 33). Logistics tasks have shown great growth with the rapid development of the logistics industry as well as related industries such as e-commerce. Consequently, greatly increasing demands on logistics, sustainable cost-efficiency policies related to logistics services, the cost, profit pressure and environmental pressure of logistics service

organizations have forced companies to consider their current strategic decisions regarding logistics and distribution operations (Liu et al., 2018: 602). In addition, companies have actually moved towards the trade-off between manufacturing and recycling (Afshar-Bakeshloo et al., 2021). This is because recycling has become a strategy that some companies place in their priorities (Shaik & Abdul-Kader, 2012: 23).

Here, we must distinguish between many related designations; the most prominent is the closed-loop supply chain which takes into account when designing the recalled products. Also, in this series, the front and reverse supply chain is combined into one system. Another nomenclature is the reverse supply chain, which includes a set of activities for the recovery of used or unused products from the customer to be then either disposed of, reused or resold. As such, reverse logistics is part of the reverse supply chain. In contrast, green logistics is closely related to the goals of the reverse supply chain and the green supply chain. This is because green logistics tries to measure and reduce the environmental impact of logistical activities. In this regard, Ferrer & Clay Whybark (2000: 55) states that recycling is the least attractive option for manufacturers. In return, this process provides many benefits, such as reducing the need for raw materials and disposal space. But it involves the use of energy resources, transportation and processing and this process requires the use of logistical skills, disassembly and sorting.

The aim of this research includes the strategic and operational aspects. On the strategic aspect, the objective is to analyze the major contributors to the sustainability of industrial operational management. The operational objectives of this study are to identify the daily problem facing the industry and analyze the cause of the problems. Through a comprehensive literature review and case study, a sustainable industrial marketing framework is proposed and eight proposals are derived from the discussion. In order to solve the problem, a corresponding solution is proposed to improve the performance and efficiency of reverse logistics services. The management implications are discussed and the direction for future research is listed in the conclusion.

The main objective of the study is to determine the reverse logistics options adopted by some foreign companies that have a market share in Iraq, compared to the options adopted by local companies. As this goal will be achieved by conducting a survey on the agents of foreign companies to know the approved options for dealing with defective or expired products or products that require repairs. As well as conducting an investigation about the options approved by local companies and the nature of dealing with expired products or requiring repairs. ... etc and the cost of each option. This study also provides a general framework for options for reverse logistics and ways to develop it as a competitive advantage. The second objective of the study is to find support for the importance of reverse logistics services among researchers and academics. The first objective will be achieved using qualitative analysis through developing a successful reverse logistics framework. While the second objective will be achieved by using content analysis by critically reviewing the results of previous researchers regarding reverse logistics, respectively. This article also provides transport pipeline, reverse supply and flow properties.

## 2- Literature Review

### 2-1 Reverse Logistics

Reverse logistics is a great enabler for sustainable production. Its definition and scope has been evolving since the early 1980s. Reverse logistics assumed in its inception that it consisted of four basic operations:

collection, sorting, testing, recovery and redistribution (Sangwan, 2017: 257), and then expanded to include remarketing (Shi et al., 2020: 94), and warehousing (Ramírez & Morales, 2014: 955). During the past few years, the volume of products recovered from customers increased in various forms, including products whose useful life has expired, defective products (Grabara & Kot, 2009: 55) or operations related to reuse and reprocessing of products and materials (Rasi, 2018: 66). All these operations and activities are based on the so-called reverse logistics considerations, which are shown in Table (1). This recall process began with a continuous increase due to the short product life cycle (Afra & Behnamian, 2021). However, there was no apparent interest in reverse logistics and were only a fraction of the channelling distribution. Many managers considered reverse logistics to be merely a recycling or repackaging operation (Pacheco et al. 2020: 30963). Despite the fact that reverse logistics can significantly affect a company's finances and relationships with customers, its strategic value is often overlooked (Autry et al., 2001: 27), (Michael Knemeyer et al., 2002). The reverse supply chain has gained increased interest by industries due to the high return rates of products. Conversely, many strategic and economic benefits can be obtained by efficiently managing the reverse supply chain, such as reducing costs and improving environmental performance (Ahlström et al., 2020: 1) (Bazan et al., 2016). Simply, there are four main steps to reverse logistics. The first step begins with collecting the products used. Next, the products are examined and sorted. Then the step of reprocessing or direct recovery of used products. The session ends with a redistribution step (Konstantaras, 2010: 2). Reverse logistics relates to the transportation of goods from the consumer to the producer in the distribution channel (David et al, 2017: 196). In some cases, defective products are discovered after entering the supply chain, which leads to the return of products across the chain, which are called (product withdrawals) (Brit et al, 2002: 2). As reverse logistics has become an important issue with the customer, allowing revenue from the customer is an important marketing tool. But it does lead to the emergence of what middlemen think is what is known as a headache when dealing with goods returned by a customer. This is because the idea of reverse logistics contradicts the instincts of every retailer. It adds any value to the supply chain (Mukhopadhyay & Setaputra 2006: 716).

Table (1) reverse logistics considerations

| Return policy | Customers' requirements | Operations considerations |
|---|---|---|
| **Refund procedures** | Manufacturers and suppliers: To coordinate joint efforts to ensure that returned products are delivered to customers after making adjustments with the same usual quality. | Safety: Ensure that the returned products are separated from the others. |
| **Checking and checking before returning** | Distributors and end-users: relates to the accuracy of information | Receipt Operations: Ensure that retrieved shipments are not discharged in the wrong places. |

| | | |
|---|---|---|
| **Ensure exceptions** | | Work: such as examination and inspection processes and product handling methods. |
| **Determine the method of handling the product** | | |

In general, the process of handling products at the end of their life cycle when they may harm the environment and humans is called reverse logistics (Kargar et al., 2020: 2). So, reverse logistics is the process of planning, executing, controlling the internal flow, storage of secondary goods and information related to the supply chain for the purpose of value creation (Salema et al., 2007: 1063) (Srivastava, 2008: 538) (Soleimani & Govindan, 2014: 487). The strategic change that is occurring is best described. Reverse logistics should not be viewed as an expensive side-issue of normal operations. Rather, it should be seen as an opportunity to build a competitive advantage (Genchev, 2009: 139).

### 2-2 Reverse Logistics Options

According to (Felicitas Schlierf et al., 2020: 159) the successful implementation of reverse logistics networks requires many decisions regarding different levels of hierarchy such as strategic, tactical, and operational. In practice, many reverse logistics networks can be observed that depend on the nature of the returned product (end of life etc.), the recovery process (re-manufacturing, reuse, recycling) or the front channel structure (central, decentralized). It is difficult to find a supply chain free of reverse logistics (Felicitas Schlierf et al., 2020: 159-160). Table (2) shows the operations, activities and options of reverse logistics and all costs related to each operation or activity, and on this basis the challenges of reverse logistics are as follows:

- Negative customer perception when returning products.
- The high cost associated with reverse logistics.
- Doubts related to product return.
- Lack of cooperation between supply chain partners.
- Lack of senior management awareness of the importance of reverse logistics services.
- The inaccuracy of forecasting in the reverse logistics chain.

Table (2) Operations and options for reverse logistics and their costs

| Reverse logistics operations | Logistics operation costs | Options for reverse logistics | Costs of reverse logistics activities |
|---|---|---|---|
| **Collect products** | Work and machine | Return to the seller: return the product to the original supplier and get a refund | Transportation, negotiation |
| **Examination, sorting and storage** | Work: machine and indirect costs | Reuse: resale, redistribution, product repair, product renewal and changeover, packaging | Work: machine, indirect costs, raw materials, transportation, storage costs and loss of value. |
| **Work: machine and indirect costs, raw materials, and energy** | Recycle | Work: machine, indirect costs, raw materials and transportation | Product repair and disposal |
| **Part of the total product cost** | Discount from the price | | |
| **Work, machine, and power** | Recycling | | |
| **Transport** | Donation: Sometimes organizations decide to give returned products to charitable organizations without receiving any compensation for these products. | | |
| **Disassembling costs** | Recovery of materials or parts | | |
| **Transport** | Disposing of products that cannot be reused or the cost of recycling them is useless, either by burning or landfill. | | |

We note from the previous that each of these trends indicate a different criterion for defining reverse logistics operations. As (Grabara & Kot, 2009) and (Kinobe et al., 2015) emphasized the element of waste minimization and the placing of reverse logistics services in the context of environmental management. In contrast (Salema et al., 2007) and (Srivastava, 2008) indicate the direction of commodity flow with respect to the sender and receiver supply chain sites. Finally, others refer to reverse logistics as being part of a closed loop in the supply chain.

In the literature, the importance of legislation to get companies to adopt reverse logistics has been emphasized. However, many countries lack this type of policy (Beiler et al., 2020: 2). Back-to-back processing chains deal with end-of-life products, and they provide the benefits of reducing solid waste, creating new jobs, generating income from sales of recycled products and provision of raw materials. At the same time, their design is more complex compared to front-line supply chains due to the difficult to predict backlash (Krug et al., 2019: 499). In addition to the difficulty of coordination between the various players in the supply chain such as wholesalers, retailers, consumers, collecting and recycling organizations (Demajorovic et al., 2016: 118) or as described by (Chileshe et al., 2015) internal and external difficulties. In managing their activities, companies aim to reduce the costs of these activities (Zhang et al., 2013). However, Internet of Things (IoT) technology is a promising technology that has been applied in the manufacturing process to sense data on manufacturing resources in real time, which is of great importance in this field. The acquisition and sharing of real-time information on logistical activities is essential that helps to deal with logistical activities, such as radio frequency identification ((Liu et al., 2018: 663), as well as the EPR system, which addresses the last of its stages, product and disposal (Plakas et al., 2021: 1681). However, reverse logistics activities have become a major direction for balancing economic development and environmental protection (Lee & Lam, 2012) (Jimenez et al., 2019: 367). Reverse logistics is suitable for dealing with environmental challenges and plays an important role in recycling, waste disposal and hazardous materials management (Yang et al., 2017). Therefore, reverse logistics is a weapon to counteract environmental damage (Kulwiec, 2006) and as a strategy to achieve customer satisfaction (Liao, 2018). However, it has become more complex (Panigrahi et al., 2018) and a dynamic process (Rajagopal et al., 2015: 47). (Janeiro et al., 2021: 1666) indicates that logistics includes providing the right product in the right way, in the right quantity, with quality. The right, in the right place, at the right time, for the customer. The right price is affordable, and in return ensure sustainable competitive advantage (Agrawal et al., 2015: 89) and environmental sustainability (Narayana et al., 2019: 968). This effort is expected to reduce environmental costs and waste disposal (Narayana et al., 2019: 285), and usually leads companies to move towards reverse supplies (Paula et al., 2019).

- Economic factors related to production costs, raw materials usage, and environmental costs.
- Governmental factors that include legislation and policies related to the environment.
- Corporate responsibility, which translates into the collection of waste generated after the end of the useful life of the products.
- Technological factors related to advances in recycling and green design where products are designed to facilitate the reverse process.
- Logistical factors that deal with reverse channels and other aspects.

From another point of view, there are three levels of factors and benefits from implementing reverse logistics. The first level is economic, the second is environmental (Sobotka & Czaja, 2015) and finally is social, which is concerned with improving the business image, generating many jobs and reducing all types of pollution (Pushpamali et al., 2019: 2). This is highly dependent on the continuous flow of information between all supply chain firms (García-Sánchez et al., 2018:2) (Olorunniwo & Li, 2010:455) (BROWNE, 2001). Companies bear the responsibility of collecting end-of-life products and dealing with them in the correct

manner (de Campos et al., 2017:375) and this is what a few international companies have followed (Bernon et al., 2011:485) and worked to improve their logistics services as well (Agrawal et al., 2015: 89) and increasing profits (Huang & Su, 2013: 633). This process requires the establishment of efficient and appropriate reverse logistics networks for the flow of products from the consumer to the producer (Zhou et al., 2010: 3667).

## 3- Research methodology

In the European Union (EU) a directive has been issued regarding the handling of waste from electrical equipment. Member states operate according to unified national legislation. In the United States, there are hundreds of environmental laws and regulations within individual states, in addition to regulations and laws for the federal government to deal with waste. In Japan, any products that the government purchases under the law must have a specific content of recycled materials. In the Netherlands, manufacturers are responsible for collecting, processing and recycling used products such as refrigerators, washing machines, freezers, televisions, consumer electronics items and associated packaging. This research paper tends to study the content of Iraqi legislation and laws regarding dealing with waste raised by local and international companies, and in order to study this topic, three basic steps were taken:

### Step 1: Identify the problem

In the first step, the research problem of increasing waste in Iraq was identified, according to the official reports issued by the Iraqi government from 2017-2020. To narrow down the problem more precisely, a number of international companies that have a large market share in Iraq have been selected, namely (Apple, Samsung, Huawei, AMARON, and Hitachi). Furthermore a specific number of products shown in Table (3), on the other hand, a number of local companies have been identified with a number of their products, namely (Diyala State Company, The State Company for Electrical and Electronic Industries, The State Company for Rubber Industries and Tires, Babel Battery Factory Alhilal. And Industrial Company). It was determined the number of companies and their products as a sample for the current research, to verify the environmental strategies adopted by these companies.

### Step 2: Determine the reverse logistics options adopted by foreign companies in Iraq.

After identifying the research problem, this step is to determine the options approved by foreign companies operating in Iraq. To collect data on this process, a field survey was conducted for all agents of these companies in Baghdad and a number of agents in other governorates. The aim of this process is to limit the options and policies that these companies adopt when dealing with expired products, defective products, or products that need maintenance. The verification of these options is carried out according to a pre-prepared list containing all the options provided by the reverse logistics shown in Table (2).

### Step 3: Determine the reverse logistics options approved by local companies

To determine the reverse logistics options approved by Iraqi companies. A field survey was conducted through visits to companies and their agents and customer service centres to verify the nature of the services provided to customers with the aim of determining the ways companies deal with defective or expired products or products that need maintenance, especially during the warranty period. As well as the nature of

the raw materials included in the production process, are they natural materials or recycled materials. After that, a comparison is made in terms of these options with foreign companies.

## 4- Data And Analysis

Reverse logistics is a fairly new concept in the field of logistics. It has gained increasing importance as a useful and sustainable business strategy, and reverse logistics is affected by both strategic and operational factors. Strategic factors consist of strategic costs, overall quality, customer service, environmental concerns, and legislative concerns. While the operational factors consist of cost-benefit analysis, transportation, warehousing, supply chain management, recycling, and packaging. Together, insights on these elements constitute the latest knowledge on the keys to successful design and use of reverse logistics systems. Reverse logistics is an important process that is often misunderstood. Reverse logistics can incur a heavy cost if poorly designed. On the other hand, it provides many opportunities, as many organizations are not aware of the correct processes and procedures to follow and how to manage reverse logistics efficiently.

From this point of view, the research is based in its methodology on verifying the procedures of some of the companies shown in Table (3). This has a market share in Iraq and that works to export its products to Iraq and the means of dealing with its recovered, defective and expired products or their productive life, according to the options provided by the reverse logistics.

Table (3) local and foreign companies and their products approved in the study

| | International company | The product | Local companies | The product |
|---|---|---|---|---|
| 1 | Apple | Cell phones | Diyala State Company | Electrical transformer 100/11 KAV |
| | | PC | The State Company for Electrical and Electronic Industries | Cooling conditioners |
| 2 | Samsung | Cell phones | Babel Battery Factory | Batteries |
| | | Domestic devices | The State Company for Rubber Industries and Tires | Tires |
| 3 | Huawei | Cell phones | Al Hilal Industrial Company | Evaporative air cooler |
| | | | | Generators |
| 4 | AMARON | Batteries | | |
| 5 | HITASHI | Domestic devices | | |

Through the data shown in Table (3), we aim to make a comparison about the nature of the measures taken by these companies towards their products according to the options of reverse logistics such as

maintenance, recycling, re-use, etc. As well as the procedures of international companies regarding their products in Iraq. Here, we show the most important strategies adopted by many international companies towards the environment:

- Low-carbon design: Design products and manufacturing processes to be less carbon intensive.
- Energy efficiency and renewable energy: The use of alternative energy, which is called clean energy, as an important environmental alternative, which begins with the design of buildings and products. Energy efficiency programs aim to control the use of gas, coal and oil in order to obtain electricity in factories and production companies. These programs also extend to all operations of the supply chain.
- Direct emissions abatement: The reduction of emissions is being addressed through technological improvements. This means reducing the point of use, changing a process to reduce associated emissions, or shifting fuel to a low-carbon source to reduce global warming. Some companies are also moving to reduce employee mobility through remote work, in order to reduce emissions resulting from this mobility.

The intensity of the carbon emitted depends mainly on the product design process, with the aim of minimizing the use of the main materials involved in the manufacturing process. In 2019, Apple was able to reduce carbon by 4.3 million metric tons as a result of improving the glossing process as is the case with global companies. As for energy efficiency, international companies are working to find innovative ways to reduce the use of electric energy and increase reliance on clean energy as a real alternative. And because of the strict legislation in some developed countries, international companies are working to find techniques to reduce direct emissions generated from factories affiliated with these companies directly. It is worth noting that the Iraqi local companies do not have any of these strategies, as they depend entirely on electric power and do not have any methods for using renewable energy or reducing direct emissions. This matter is due to the lack of binding legislation for this matter, in addition to the troubled security and political problems that impede the implementation of these strategies see Table (4). In order to reach the results of a comparison between international and local companies regarding the options approved for them to deal with their products in the Iraqi market, we will address them in the following paragraphs.

Table (4) Strategies for dealing with the environment

| Strategies | International companies | Local companies |
|---|---|---|
| **Low-carbon design** | Yes | No |
| **Energy efficiency** | Yes | No |
| **Directemissions abatement** | Yes | No |

**4.1- Foreign companies**

The responsibility of the products when they reach the end of life is assumed to be the responsibility of the manufacturer. Apple (Environmental Progress Report, 2020) claims that when a device cannot work as intended, it is working to restore it in the best way that it can be reused. Thus for the parts that can't be reused, they are designing new technologies to unlock the useful materials inside. Through reuse and recycling of products. As is the case for Samsung, which claims to consider environmental impacts at every stage of the product life cycle, from design and manufacture to purchase and use, to end-of-life remediation and disposal. Samsung is committed to continually improving energy efficiency and recyclability, and reducing hazardous substances in products through an environmentally friendly design process. An environmental rating system assesses the sustainability performance of all products throughout their life cycle. This is what Huawei has worked with, according to its report (Sustainability Report, 2019). It is worth noting that these options are not applied in the Iraqi environment, as shown in Table (5). AMARON holds consumers, dealers and manufacturers responsible for the safe collection and disposal of scrap batteries. This is what HITASHI claims that it adopts the circular economy as its basic strategy. However, the waste generated from the products of these companies, especially electronic waste or digital waste, is not ordinary waste. According to the Basel Global Convention, which deals with controlling the transport of hazardous wastes, it is classified as "hazardous waste", because it contains hazardous materials that are supposed to be treated or recycled in an environmentally sound manner.

Table (5) options approved by international companies in Iraq

| Options / The company | product repair | Discount from the price | Back to the seller | reuse | Resale, redistribution | Product renewal and changeover | Refabricate | Recycle | Get rid of products | Gift |
|---|---|---|---|---|---|---|---|---|---|---|
| Apple | ✓ | ✓ | ✓ | | | | | | | |
| Samsung | ✓ | ✓ | ✓ | | | | | | | ✓ |
| Huawei | ✓ | ✓ | ✓ | | | | | | | ✓ |
| AMARON | ✓ | ✓ | | | | | | | | |
| HITASHI | ✓ | ✓ | ✓ | | | | | | | ✓ |

The electronic waste generated in the world for the year 2016 is estimated at (44.7 million tons), only 20% of which are documented as collected and recycled properly, while 80% are undocumented. This is due, among other things, to the limitation of logistical options approved by scientific companies to only two options in most countries, which are improve the product and price discount. Product repair is carried out by performing maintenance on products that appear defective after being used by the customer. This maintenance is done through the agents approved by these companies in Iraq, and the maintenance process

is carried out in accordance with the product guarantee, which means that maintenance takes place for a specific period of the product's life span. In the event that no manufacturing defects appear during the warranty period, the product will not be returned to the original origin, and the agent will be compensated through a discount from the product price. The limitation of these companies to these options is a result of the fact that these companies do not have factories or advanced maintenance centres capable of adopting other options such as remanufacturing, product renewal, or recycling. The other reason is the high cost of transportation when agents want to return the products to the original origin in the countries where these products were manufactured. As the limited adoption of these goods, has caused an increase in environmental pollution in Iraq to high levels. These companies have a maintenance method only when dealing with defective products only, and these are short-term plans. In contrast, these companies do not have any strategies to deal with products when they reach the end of their useful life. These companies apply all the options of reverse logistics in many countries, the most important of which is the European Union. In fact, we have to admit that the lack of implementation is due to the weakness of the Iraqi government's role towards the environment, and this is what made the interest in environmental affairs to a minimum. In addition, Iraq is not covered by the legislation on the collection and treatment of electronic waste.

Iraq does not have any statistics about the volume of waste for such products, because there is no specific system for collecting or treating them. It is also a commercial system based mainly on importing and introducing electronic waste into Iraq under the title "used electronic materials" or what is called in Iraq "Bale" and this is what makes the matter worse. Also, under the pretext of "assistance", some rich countries export (used) devices to poor countries or to third world countries, including Iraq. But in fact, it seeks to get rid of these devices cheaply, as strict laws in these countries prohibit random disposal or causing environmental damage. Therefore, these wastes are exported on ships to Asian and African countries, to fall into the hands of workers who work in the sector of "recycling" and they are exposed to risks. Countries such as India and China have long been the main destination for burying electronic waste coming from the United States and Europe through some merchants who look at the financial returns of this trade regardless of its risks. Despite the lack of adequate studies and surveys of how Iraq deals with the scrap trade, data on scrap trade confirm that Iraq is the largest importer of used electronic devices, at the rate of a huge container per month. Whose load reaches thousands of tons of electrical and electronic devices that have a great potential to be transformed into waste and scrap.

### 4.2 Local companies

Local companies have more logistical options to deal with their products compared to international companies, as shown in Table (6). This makes it in a better competitive position according to the quality of the product, as a result of close distance of the factories to customers. This allows these companies to better deal with their defective products retrieved from customers. All these companies are granted, according to the guarantee, the possibility of repairing the defective product or retrieving the product that cannot be repaired to be subsequently reprocessed, redistributed and sold in the market. As well as the use of these companies some raw materials recycled in Iraq by some recycling companies. Iraq has many recycling plants

that have limited waste, especially plastic ones. According to the report issued by the Ministry of Planning for the year 2015, the companies affiliated with the Ministry of Industry and Minerals release (6604.8) tons of solid waste per month.

Table (6) options approved by Iraqi companies

| Options / The company | product repair | Discount from the price | Back to the seller | reuse | Resale, redistribution | Product renewal and changeover | Refabricate | Recycle | Get rid of products | Gift |
|---|---|---|---|---|---|---|---|---|---|---|
| Diyala State Company | ✓ | | ✓ | | ✓ | | ✓ | ✓ | | ✓ |
| The State Company for Electrical and Electronic Industries | ✓ | | ✓ | | ✓ | ✓ | ✓ | ✓ | | |
| Babel Battery Factory | ✓ | | | | | | | ✓ | ✓ | |
| The State Company for Rubber Industries and Tires | ✓ | | | | | | | | ✓ | |
| Al Hilal Industrial Company | ✓ | | ✓ | | | ✓ | | | | ✓ |

Most of the Iraqi manufacturing companies are working on the use of all reverse logistics options, and this has led to the reduction of solid waste presented by them. On the other hand, these options are considered expensive for these companies, as the cost of repairing products after the product malfunctions during the warranty period for Diyala Company amounted to 36551 dollars, and the loss achieved when returning the product from the customer amounted to 9300 dollars. In general, the logistical options for Diyala State Company for one of the products cost $ 18,500. As for the cost borne by the General Company for Electrical and Electronic Industries, it amounted to 35,800 dollars. These options represent an element of cost affecting the return on the contribution achieved by these products see Table (7), and at the same time these options represent competitive priorities in the Iraqi market, which puts local companies in a critical

predicament, which is bearing these costs at the expense of the competitive advantage envisaged by these options.

Table (7) the cost of logistical options for local companies in Iraq

| Options / The company | product repair | Discount from the price | Back to the seller | reuse | Resale, redistribution | Product renewal and changeover | Refabricate | Recycle | Get rid of products | Gift |
|---|---|---|---|---|---|---|---|---|---|---|
| Diyala State Company | 36551 | | 9300 | | 1150 | | 3250 | 4800 | | 44827 |
| The State Company for Electrical and Electronic Industries | 15000 | | 1800 | | 1000 | 10000 | 6000 | 17000 | | |
| Babel Battery Factory | 21000 | | | | | | | 12000 | 9000 | |
| The State Company for Rubber Industries and Tires | | | 14000 | | | | | | 11000 | |
| Al Hilal Industrial Company | 8500 | | 2300 | | | 2900 | | | | 3000 |

## 5- Results and discussion

The results of the study showed that international companies such as (Apple, Samsung, Huawei, Hitachi) depend in their production processes and design on several strategies to deal with environmental risks. These strategies were represented by (Low-carbon design, energy efficiency, direct emissions abatement) with the exception of AMARON, according to the annual report on the environment, which is published on its

websites. The tendency towards concern for the environment and the adoption of these strategies increased as a result of the increase in international pressures to use recycled materials as inputs for production processes, in accordance with the laws and regulations of the countries to which these companies belong. On the other hand, the results showed that local companies do not adopt any of these strategies when producing and designing processes, and of course this is due to the nature of government policies and programs that oblige these companies to adopt recycled materials as inputs.

The failure to include Iraq in the legislation on solid waste management, especially electronic ones, encouraged many electronic and electrical companies. Especially the sample companies that searched for reducing the options for reverse logistics, as they were limited to maintenance, deduction from the price, or donations at low prices. When comparing these options with the options approved by the local companies, we find that the Iraqi companies outperform them in terms of the number of options, which recently contributed to the decline in solid waste generated by these companies, and in return this process led to an additional cost. The management of reverse logistics requires great efforts to control it, especially in Iraq due to the lack of laws and legislations that govern this process, whether for global or local companies, as adopting more reverse logistics options requires an appropriate legislative system with policies for sustainable development, which is based on the collection, recycling and retrieval of electronic waste. In particular, it handles its trans boundary movement. As well as adopting a green design approach that aims to reduce the use of hazardous materials in electronic and electrical products and to enhance the ability to recycle them and work to close the gap for recyclable materials. As well as improving the quality of local products and controlling imported ones to extend the shelf life of products through reuse, renewal or repair. And setting global levels or standards for environmentally sound management in relation to electronic waste recycling and final disposal, and this is called the circular economy. The important thing is to create public-private partnerships to involve all stakeholders.

In this paper, we note that there is an increase in remanufacturing and redistribution processes in many parts of the world. This is according to three factors. First: The increasing prevalence of environmental laws and regulations. Second, consumers are accepting products made from recycled materials. Third, some companies find recycling and remanufacturing, processing used products, materials and packaging to be a good business that represents additional sources of income.

**References**

1. Afra, A. P., & Behnamian, J. (2021). Lagrangian heuristic algorithm for green multi-product production routing problem with reverse logistics and remanufacturing. *Journal of Manufacturing Systems*, *58*(PA), 33–43. https://doi.org/10.1016/j.jmsy.2020.11.013
2. Afshar-Bakeshloo, M., Jolai, F., & Bozorgi-Amiri, A. (2021). A bi-objective manufacturing/remanufacturing system considering downward substitutions between three markets. *Journal of Manufacturing Systems*, *58*(PA), 75–92. https://doi.org/10.1016/j.jmsy.2020.11.010
3. Agrawal, S., Singh, R. K., & Murtaza, Q. (2015). A literature review and perspectives in reverse logistics. *Resources, Conservation and Recycling*, *97*, 76–92. https://doi.org/10.1016/j.resconrec.2015.02.009
4. Ahlström, F., Ferning, C., Cheniere, M. K., & Sorooshian, S. (2020). Performance indicators of

textile reverse logistics. *IOP Conference Series: Earth and Environmental Science*, *442*(1). https://doi.org/10.1088/1755-1315/442/1/012012

5. Autry, C. W., Daugherty, P. J., & Glenn Richey, R. (2001). The challenge of reverse logistics in catalog retailing. *International Journal of Physical Distribution and Logistics Management*, *31*(1), 26–37. https://doi.org/10.1108/09600030110366384
6. Bazan, E., Jaber, M. Y., & Zanoni, S. (2016). A review of mathematical inventory models for reverse logistics and the future of its modeling: An environmental perspective. *Applied Mathematical Modelling*, *40*(5–6), 4151–4178. https://doi.org/10.1016/j.apm.2015.11.027
7. Beiler, B. C., Ignácio, P. S. de A., Pacagnella Júnior, A. C., Anholon, R., & Rampasso, I. S. (2020). Reverse logistics system analysis of a Brazilian beverage company: An exploratory study. *Journal of Cleaner Production*, *274*. https://doi.org/10.1016/j.jclepro.2020.122624
8. Bernon, M., Rossi, S., & Cullen, J. (2011). Retail reverse logistics: A call and grounding framework for research. *International Journal of Physical Distribution and Logistics Management*, *41*(5), 484–510. https://doi.org/10.1108/09600031111138835
9. Brito, M. P. De. (2018). *M A R I S A P . D E B R I T O Managing Reverse Logistics or Reversing Logistics Management ?January*.
10. BROWNE, N. F. & J. (2001). Issues in end-of-life product recovery and reverse logistics. *Production Planning & Control*, *12*(5), 534–547. https://doi.org/10.1080/09537280110042888
11. Chileshe, N., Rameezdeen, R., & Hosseini, M. R. (2015). Barriers to implementing reverse logistics in South Australian construction organisations. *Supply Chain Management*, *20*(2), 179–204. https://doi.org/10.1108/SCM-10-2014-0325
12. David B Grant, A. T., & Wong, and C. Y. (2017). Sustainable Logistics and Supply Chain Management Principles and practices for sustainable operations and management. In *British Library Cataloguing-in-Publication Data*. http://dx.doi.org/10.1016/j.jsames.2011.03.003%0Ahttps://doi.org/10.1016/j.gr.2017.08.001%0Ahttp://dx.doi.org/10.1016/j.precamres.2014.12.018%0Ahttp://dx.doi.org/10.1016/j.precamres.2011.08.005%0Ahttp://dx.doi.org/10.1080/00206814.2014.902757%0Ahttp://dx.
13. de Campos, E. A. R., de Paula, I. C., Pagani, R. N., & Guarnieri, P. (2017). Reverse logistics for the end-of-life and end-of-use products in the pharmaceutical industry: a systematic literature review. *Supply Chain Management*, *22*(4), 375–392. https://doi.org/10.1108/SCM-01-2017-0040
14. Demajorovic, J., Augusto, E. E. F., & De Souza, M. T. S. (2016). Reverse logistics of E-waste in developing countries: Challenges and prospects for the Brazilian model. *Ambiente e Sociedade*, *19*(2), 117–136. https://doi.org/10.1590/1809-4422ASOC141545V1922016
15. Felicitas Schlierf, J., Heinen, B., Jović, M., & Tijan, E. (2020). Information management in Reverse logistics. *Pomorski Zbornik*, *58*(1), 155–167. https://doi.org/10.18048/2020.58.10.
16. Ferrer, G., & Clay Whybark, D. (2000). From garbage to goods: Successful remanufacturing systems and skills. *Business Horizons*, *43*(6), 55–64. https://doi.org/10.1016/s0007-6813(00)80023-3
17. García-Sánchez, E., Guerrero-Villegas, J., & Aguilera-Caracuel, J. (2018). How do technological skills improve reverse logistics? The moderating role of top management support in information technology use and innovativeness. *Sustainability (Switzerland)*, *11*(1), 1–17. https://doi.org/10.3390/su11010058
18. Genchev, S. E. (2009). Reverse logistics program design: A company study. *Business Horizons*, *52*(2),

139–148. https://doi.org/10.1016/j.bushor.2008.09.005

19. Grabara, P. P. D. J. K., Kot, P. P. D. S., & Technical. (2009). Theoretical Frames for Designing Reverse Logistics Processes. *Review of General Management*, *09 (1)*, 55–61.
20. Apple, C. (2020). Apple Inc Environmental Progress Report for year 2020. *Chemical and Engineering News*, *82*(43), 45–46.
21. Huang, S. M., & Su, J. C. P. (2013). Impact of product proliferation on the reverse supply chain. *Omega (United Kingdom)*, *41*(3), 626–639. https://doi.org/10.1016/j.omega.2012.08.003
22. Janeiro, R., Pereira, M. T., Ferreira, L. P., Sá, J. C., & Silva, F. J. G. (2021). *ScienceDirect ScienceDirect New conceptual model of Reverse Logistics of a worldwide Fashion Company*. *00*(2020). https://doi.org/10.1016/j.promfg.2020.10.232
23. Jimenez, G., Santos, G., Félix, M., Hernández, H., & Rondón, C. (2019). Good Practices and Trends in Reverse Logistics in the plastic products manufacturing industry. *Procedia Manufacturing*, *41*, 367–374. https://doi.org/10.1016/j.promfg.2019.09.021
24. Kargar, S., Pourmehdi, M., & Paydar, M. M. (2020). Reverse logistics network design for medical waste management in the epidemic outbreak of the novel coronavirus (COVID-19). *Science of the Total Environment*, *746*, 141183. https://doi.org/10.1016/j.scitotenv.2020.141183
25. Kinobe, J. R., Gebresenbet, G., Niwagaba, C. B., & Vinnerås, B. (2015). Reverse logistics system and recycling potential at a landfill: A case study from Kampala City. *Waste Management*, *42*, 82–92. https://doi.org/10.1016/j.wasman.2015.04.012
26. Konstantaras, I. (2010). Optimal control of production and remanufacturing in a reverse logistics model with backlogging. *Mathematical Problems in Engineering*, *2010*. https://doi.org/10.1155/2010/320913
27. Krug, Z., Guillaume, R., & Battaïa, O. (2019). Lexicographic r* criterion for decision making under uncertainty in reverse logistics. *IFAC-PapersOnLine*, *52*(13), 499–504. https://doi.org/10.1016/j.ifacol.2019.11.113
28. Kulwiec, R. (2006). Reverse logistics provides green benefits. *Target*, *22*(3), 11–20.
29. Lee, C. K. M., & Lam, J. S. L. (2012). Managing reverse logistics to enhance sustainability of industrial marketing. *Industrial Marketing Management*, *41*(4), 589–598. https://doi.org/10.1016/j.indmarman.2012.04.006
30. Liao, T. Y. (2018). Reverse logistics network design for product recovery and remanufacturing. *Applied Mathematical Modelling*, *60*, 145–163. https://doi.org/10.1016/j.apm.2018.03.003
31. Liu, S., Zhang, G., & Wang, L. (2018). IoT-enabled Dynamic Optimisation for Sustainable Reverse Logistics. *Procedia CIRP*, *69*(May), 662–667. https://doi.org/10.1016/j.procir.2017.11.088
32. Michael Knemeyer, A., Ponzurick, T. G., & Logar, C. M. (2002). A qualitative examination of factors affecting reverse logistics systems for end-of-life computers. *International Journal of Physical Distribution and Logistics Management*, *32*(6), 455–479. https://doi.org/10.1108/09600030210437979
33. Mukhopadhyay, S. K., & Setaputra, R. (2006). The role of 4PL as the reverse logistics integrator: Optimal pricing and return policies. *International Journal of Physical Distribution and Logistics Management*, *36*(9), 716–729. https://doi.org/10.1108/09600030610710872
34. Narayana, S. A., Pati, R. K., & Padhi, S. S. (2019). Market dynamics and reverse logistics for sustainability in the Indian Pharmaceuticals industry. *Journal of Cleaner Production*, *208*, 968–987.

https://doi.org/10.1016/j.jclepro.2018.10.171

35. Olorunniwo, F. O., & Li, X. (2010). Information sharing and collaboration practices in reverse logistics. *Supply Chain Management*, *15*(6), 454–462. https://doi.org/10.1108/13598541011080437
36. Pacheco, D. H., Anderson, M., Novais, P. De, Mello, M., & Liberal, C. De. (2020). *The benefits of reverse logistics in the health area*. *October 2019*.
37. Panigrahi, S. K., Kar, F. W., Fen, T. A., Hoe, L. K., & Wong, M. (2018). A Strategic Initiative for Successful Reverse Logistics Management in Retail Industry. *Global Business Review*, *19*(3_suppl), S151–S175. https://doi.org/10.1177/0972150918758096
38. Paula, I. C. de, Campos, E. A. R. de, Pagani, R. N., Guarnieri, P., & Kaviani, M. A. (2019). Are collaboration and trust sources for innovation in the reverse logistics? Insights from a systematic literature review. *Supply Chain Management*, *25*(2), 176–222. https://doi.org/10.1108/SCM-03-2018-0129
39. Huawei. (2019). *2019 Sustainability Report, Boral*. *June 2020*, 32–42. https://www.boral.com/community-sustainability/sustainability-report
40. Plakas, G., Ponis, S. T., Agalianos, K., & Aretoulaki, E. (2021). ScienceDirect ScienceDirect Reverse Logistics of End-of-Life Plastics Using Industrial IoT and LPWAN Technologies – A Proposed Solution for the Bottled Water Industry. *Procedia Manufacturing*, *51*(2020), 1680–1687. https://doi.org/10.1016/j.promfg.2020.10.234
41. Pushpamali, N. N. C., Agdas, D., & Rose, T. M. (2019). A review of reverse logistics: An upstream construction supply chain perspective. *Sustainability (Switzerland)*, *11*(15). https://doi.org/10.3390/su11154143
42. Rajagopal, P., Sundram, V. P. K., & Naidu, B. M. (2015). Future directions of reverse logistics in gaining competitive advantages: A review of literature. *International Journal of Supply Chain Management*, *4*(1), 39–48.
43. Ramírez, A. M., & Morales, V. J. G. (2014). Improving organisational performance through reverse logistics. *Journal of the Operational Research Society*, *65*(6), 954–962. https://doi.org/10.1057/jors.2013.61
44. Rasi, R. E. (2018). A Cuckoo Search Algorithm Approach for Multi- Objective Optimization in Reverse Logistics Network under Uncertainty Condition. *International Journal of Supply and Operations Management*, *5*(1), 66–80.
45. Salema, M. I. G., Barbosa-Povoa, A. P., & Novais, A. Q. (2007). An optimization model for the design of a capacitated multi-product reverse logistics network with uncertainty. *European Journal of Operational Research*, *179*(3), 1063–1077. https://doi.org/10.1016/j.ejor.2005.05.032
46. Sangwan, K. S. (2017). Key Activities, Decision Variables and Performance Indicators of Reverse Logistics. *Procedia CIRP*, *61*, 257–262. https://doi.org/10.1016/j.procir.2016.11.185
47. Shaik, M., & Abdul-Kader, W. (2012). Performance measurement of reverse logistics enterprise: A comprehensive and integrated approach. *Measuring Business Excellence*, *16*(2), 23–34. https://doi.org/10.1108/13683041211230294
48. Shi, J., Zhang, W., Zhang, S., Wang, W., Lin, J., & Feng, R. (2020). A new environment-aware scheduling method for remanufacturing system with non-dedicated reprocessing lines using improved flower pollination algorithm. *Journal of Manufacturing Systems*, *57*(June), 94–108. https://doi.org/10.1016/j.jmsy.2020.08.006

49. Sobotka, A., & Czaja, J. (2015). Analysis of the Factors Stimulating and Conditioning Application of Reverse Logistics in Construction. *Procedia Engineering*, *122*(Orsdce), 11–18. https://doi.org/10.1016/j.proeng.2015.10.002
50. Soleimani, H., & Govindan, K. (2014). Reverse logistics network design and planning utilizing conditional value at risk. *European Journal of Operational Research*, *237*(2), 487–497. https://doi.org/10.1016/j.ejor.2014.02.030
51. Srivastava, S. K. (2008). Network design for reverse logistics. *Omega*, *36*(4), 535–548. https://doi.org/10.1016/j.omega.2006.11.012
52. Yang, S., Taghipour, A., & Canel-Depitre, B. (2017). Cost optimization of reverse logistics: A review. *ACM International Conference Proceeding Series*, *Part F1312*, 158–161. https://doi.org/10.1145/3134383.3134393
53. Zhang, Z., Van Hui, Y., & Chen, H. (2013). A forward and reverse logistics shipment planning model. *Journal of the Operational Research Society*, *64*(10), 1485–1502. https://doi.org/10.1057/jors.2012.136
54. Zhou, Y., Yang, Y., Zhang, J., He, M., & Dong, B. (2010). A generic model of reverse logistics network design. *ICLEM 2010: Logistics for Sustained Economic Development - Infrastructure, Information, Integration - Proceedings of the 2010 International Conference of Logistics Engineering and Management*, *387*(1999), 3667–3673. https://doi.org/10.1061/41139(387)510.