PROPOSED MODEL FOR ENVIRONMENTAL RISK MANAGEMENT UNDER SUSTAINABILITY ACCOUNTING STANDARD (RESOURCE CONVERSION TO ELECTRICAL AND ELECTRONIC EQUIPMENT STANDARD): AN APPLIED STUDY AT THE BATTERY FACTORY – BABYLON PLANT 2

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Abstract: *The main aim of the research is to demonstrate the application of environmental risk management under the Resource Conversion to Electrical and Electronic Equipmenint Standard to reduce environmental risks. The implementation of this standard will assist industrial companies in producing environment-friendly products, as well as reducing production costs and improving battery quality. Several conclusions were reached, including that the implementation of the Resource Conversion to Electrical and Electronic Equipment Standard will help in managing hazardous waste (liquid and solid) to preserve the environment and reduce costs, thus achieving the goals of sustainability accounting by reducing environmental risks.This will have a positive impact on society. The study recommends that the General Company for Automotive and Equipment Industry (Battery Factory - Babylon Plant 2) adopts the Resource Conversion to Electrical and Electronic Equipment Standard to reduce environmental risks.*

Keywords: *Resource Conversion to Electrical and Electronic Equipment Standard, risk management, reduction of environmental risks.*

INTRODUCTION

Advanced modern technology and rapid developments in industry have revitalized and prospered the global economy. However, this development has also caused harm to the environment due to the waste produced by these industries. Industrial companies are the main cause of the waste and emissions generated during their production processes. The risks associated with these environmental impacts have had an effect on their industrial activities, natural resources, environmental impact, and social life. This has increased pressure on environmental protection advocates to call on the international community to address these environmental problems by issuing deterrent agreements and laws. Since the industry is largely responsible for these damages, it seeks to achieve the highest quality in its products, while managing environmental risks. It is therefore necessary to manage environmental risks under the standard of converting resources into electrical and electronic equipment as one of the sustainability accounting standards to reduce environmental risks resulting from waste and emissions generated by the production process in general industrial companies.

1. RESEARCH METHODOLOGY

The current study provides an exposition of the research methodology employed, which focuses on the research problem, its hypothesis, objectives, and significance, as well as its temporal and spatial boundaries, methodology, and sources. The research problem lies in the increasing environmental risks resulting from the failure to keep pace with current developments, particularly the adoption of concepts related to sustainable environmental practices, which have had a negative impact on these products and their environmental risks. The research problem can be elucidated by the following inquiries:

Firstly, given the increasing environmental risks, are industrial units, the subject of this study, capable of competing with other units?
Secondly, is there a possibility of reducing environmental risks in industrial units under the sustainability accounting standard, particularly the standard for converting resources to electrical and electronic equipment?

1.1 Research objectives:

The research aims to achieve the following objectives:

- Introducing the concept of standard conversion of resources for electrical and electronic equipment as one of the sustainability accounting standards.
- Demonstrating the importance of (criterion for conversionring resources to electrical and electronic equipment) in reducing and managing environmental risks, and presenting scenarios that contribute to that.

1.2 The importance of research

The significance of this research lies in the adoption of a resource-to-electrical and electronic equipment conversion standard as a sustainability accounting criterion, with the aim of reducing the environmental risks associated with the battery factory (Babylon 2) owned by the General Company for Automotive and Equipment Industries. This will translate into a competitive advantage for these industrial units over others in the market, thereby improving the performance of Iraqi industrial units.

1.3 Research hypothesis.

The research seeks to test that the sustainability accounting criterion, the criterion for conversionring resources to electrical and electronic equipment, contributes to reducing environmental risks.

1.4 The spatial and temporal limits of the research

A. **TemporalBoundaries**: The time boundaries of the research were limited to the financial data for the year ended on 12/2021, as they were available.

B. **Spatial Boundaries**: The battery factory (Babylon 2) in the General Company for Automotive and Equipment Industries was selected due to the availability of information that helps clarify the research idea.

2. Theoreticalframework: criterion for conversionring resources to electrical and electronic equipment

The resource conversion standard includes a set of disclosure guidelines on sustainability issues at the specific industry level of the unit, which ultimately responsible for determining the essential information. Moreover, these standards provide sustainability metrics to improve performance on sustainability issues at both the industry and unit levels. The resource conversion standards consist of a set of specialized criteria such as chemicals, machinery, equipment, and other resource conversions. This standard addresses a range of specialized criteria as shown in Table (1) below.

Table (1): Resource conversion standards

	Standard name
1	CHEMICALS
2	AEROSPACE & DEFENSE
3	ELECTRICAL & ELECTRONIC EQUIPMENT
4	INDUSTRIAL MACHINERY & GOODS
5	CONTAINERS & PACKAGING

Source: Based on SASB standards, Sustainability Accounting Standards Board, Resource Transformation Standard.

According to SASB standards, sustainability topics are identified at the industry level, which may provide essential information depending on the company's pre-defined operational context. The purpose of SASB standards is to provide guidance to management in the units ultimately responsible for determining essential information. Additionally, SASB standards provide sustainability metrics that are designed and standardized to improve performance in sustainability topics and disclosure. Units can use SASB standards to help ensure consistent, useful, comparable, and complete disclosure (SASB, 2017, p. 3). Given the industry's particular importance and its impacts on people and the environment, the third standard in the resource transformation standards group, the Electronics & Electrical Equipment standard, will be discussed in detail. This standard represents the seventh set of sustainability accounting standards issued by the Sustainability Accounting Standards Board., SASB, 2017).

2.1 Standards for Transforming Resources: Standard for electrical and electronic equipment

The electrical and electronic equipment industry includes companies that develop and manufacture a wide range of electrical components, including power generation equipment, power transformers, electric motors, switchgear, automation equipment, heating, cooling and lighting equipment, and transmission cables. These include non-construction commercial and residential building equipment, such as heating and ventilation systems. air conditioning, lighting fixtures, security devices, and elevators, electric power equipment, including conventional power generation and transmission equipment, and renewable energy equipment, industrial automation controls, measuring instruments, and electrical components used for industrial purposes, including coils, wires, and cables, and units operate in this industry worldwide and generates a large part of its revenues from outside its home country.SASB) the following topics for sustainability disclosure:

1- <u>**Energy management**</u>

The industry of electrical and electronic equipment encompasses companies that develop and manufacture a broad range of electrical components, including power generators, power transformers, electric motors, keyboards, automation equipment, heating and cooling equipment, lighting, and transmission cables. These also include non-construction commercial and residential building equipment, such as heating, ventilation, and air conditioning systems, lighting fixtures, security devices, and elevators. It encompasses electrical power equipment, including traditional power generation and transmission equipment, as well as renewable energy equipment. Industrial automation controls, measuring tools, and electrical components used for industrial purposes, including coils, wires, and cables, are also included. The units in this industry operate at a global level and generate a significant portion of their revenue from outside their home country. (SASB) has identified the following topics for sustainability disclosure (SASB, 2017, p. 22).

Table (2): Energy Management Metrics

the topic	class	Scale	Measuring unit
Energy materials management	quantitative	aaesthetic energy expended, $\frac{\text{consumed energy}}{\text{total consumed energy of the grid}} \times 100$ $\frac{\text{consumed renewable energy}}{\text{total consumed energy}} \times 100$	**percentage** **percentage**

Source: Based on the standard conversion of resources for electrical and electronic equipment.

2- <u>**Hazardous waste management**</u>

The following table shows the measures of hazardous waste management:

Units in the electrical and electronic equipment industry are faced with regulatory and operational challenges in managing their manufacturing waste. Many of these materials can pose health and environmental risks, and therefore are subject to international hazardous waste regulations. Proper treatment and disposal of hazardous waste materials is essential for minimizing the risks of remediation responsibilities and fines. In addition, units capable of reducing input waste and recycling generated waste may achieve significant cost savings and improve profitability. The specific metrics for hazardous waste management can be clarified in the following table: (SASB, 2017, p. 22).

Table (3): Hazardous waste management standards

Measuring unit	class	the scale	the topic
metric ton (ton) percentage (%)	quantitative	*amount of hazardous waste* $\frac{\text{Recycled Hazardous Waste Materials Weight}}{\text{total weight of hazardous waste}} \times 100$	**Hazardous waste management**
kilogram (kg)	quantitative	The number and total quantity of leaks reported and the quantity returned	

Source: Depending on the standard conversion of resources for electrical and electronic equipment.

3- **Product safety**

Proper safety measures and equipment testing for units can aid in mitigating reputation risks associated with retrieval operations, safeguarding sales, preventing injuries, and even accidental deaths among users of electronic and electrical equipment. If product quality, safety, and management are not effectively handled, it may lead to significant liability claims and potential regulations. By utilizing appropriate design and testing, industry units can improve performance with respect to product safety. Poor quality and unsafe products may result in revenue loss due to reputation damage, redesign costs, recalls, lawsuits, or fines. The safety product metrics can also be clarified according to the following table (SASB, 2017, p. 22).

Table (4): Product safety measures

The topic	Measuring unit	class	accounting scale
Product safety	number	quantitative	**The number of withdrawals and the total units withdrawn**
	US$	quantitative	**The amount of legal and regulatory fines and settlements associated with product safety**

Source: Based on the standard conversion of resources for electrical and electronic equipment.

4- **Product life cycle management and innovation to achieve environmental efficiency**

Electrical and electronic equipment units are facing increasing challenges and opportunities related to external environmental factors during the usage phase of their products. On the negative side, regulations are compelling units to avoid or limit the use of concerning chemicals in their products as much as possible, in addition to regulatory pressure and customer demands for reducing the environmental footprint of their products, primarily in terms of energy density.

Simultaneously, electrical and electronic equipment units that develop cost-effective energy-efficient products and solutions can benefit from increased revenue and market share, identifying stronger competitive positions, and enhancing brand value. Similarly, products and services that solve key environmental problems can represent significant market opportunities, and the specific metrics for managing the product lifecycle and innovation to achieve environmental efficiency can be elucidated in the following table:

(SASB, 2017, p. 22)

Table (5): Measures of product life cycle management and innovation to achieve environmental efficiency

the topic	Measuring unit	class	the scale
Product life cycle management and	percentage of revenue	quantitative	**Percentage of products by revenue that contain materialsIEC 62474 Admissible**
innovation to	percentage of	quantitative	**The percentage of**

achieve environmental efficiency	revenue		**qualified products by profit that meet the criteriaENERGY STAR**
	by value	-	**Revenue from products related to renewable energy and energy efficiency**
	by value	-	**Total energy cost savings achieved through energy performance contracts**

Source: Based on the standard conversion of resources for electrical and electronic equipment.

5- MATERIAL SOURCES

Electrical and electronic equipment units are experiencing a surge of both challenges and opportunities that are associated with external environmental factors during the product usage phase. On the downside, regulations mandate that these units must avoid or minimize the use of chemicals that pose a threat, and they face mounting pressure from regulators and customers alike to reduce the environmental impact of their products, especially with regards to energy consumption. However, if these units can create energy-efficient products and solutions that are cost-effective, they can reap benefits such as increased revenue and market share, stronger competitive positions, and a boost in brand value. Likewise, products and services that provide solutions to major environmental issues present significant prospects in the market. The specific steps involved in product lifecycle management and innovation to achieve environmental efficiency can be illustrated in the table below: (SASB, 2017, p. 22).

Table (6): Material source metrics

The topic	Measuring unit	class	accounting scale
Material sources	%	quantitative	**Material cost ratio for products that contain critical materials** $\frac{\text{Cost of materials containing critical materials}}{\text{The total cost of raw materials}} \times 100$
	%	quantitative	**Percentage of tungsten, tin, tantalum and gold smelters within the supply chain that are verified to be conflict-free**
	n/a	discussion and analysis	**Discuss risk management associated with the use of critical materials and conflicting metals**

Source: Based on the standard conversion of resources for electrical and electronic equipment.

According to the information presented, it is thought that the “Resource Efficiency of Electrical and Electronic Equipment” guideline is one of several sustainability accounting standards that ought to be utilized and modified to correspond with the present situation of publicly owned industrial corporations operating in the Iraqi setting. Specifically, the research sample, which is the Babylon 2 Battery Factory under the General Company for Automotive and Equipment Industry, is lacking in its consideration of the economic, environmental, and social aspects and dimensions that the standard mentions. As the Resource Efficiency of Electrical and Electronic Equipment standard is significant in mitigating environmental hazards, the study proposal will address environmental risk management to augment its concept.

2.2 Environmental risk management (concept and definition)

Risk management has evolved in its concept, as Henry Fayol’s studies in 1916 on the role of safe management and its goals in protecting the human and material assets of the economic unit from accidents that threaten its progress and fate were considered. Thus, risk management became an essential function in the unit that should parallel its administrative, technical, and commercial functions. This attention to risk management activity is the first contribution to understanding the nature of the risks that units are exposed to in order to determine what should be done to confront and mitigate their severity and effects. During the last decade of the twentieth century, there was an expansion in a part of risk management, which is environmental risk management that was limited in its results, as a strategic entity was established to register and process environmentally contaminated risks. Environmental risk management involves setting environmental policies and plans to monitor and evaluate environmental risks of industrial projects that include all stages of the production process, from obtaining raw materials to the end of the production process with the production of a product and all its related environmental aspects. (Al-Khawali, 2002, p. 207). Environmental risk management has been defined as "the process responsible for identifying and processing risks and relies on many legal, political, economic, and ethical factors" (Jemison, 1998, p. 213). Many definitions can be summarized as shown in the following table:

Table (7): Views of some researchers ondefining risks

	Year of publication	definition axis	researcher	Definition
1	2021	events	Ullahllah, et al	**Possible positive or negative events that may affect the objectives of the economic unit.**
2	2020	an opportunity	Oluwafemi	**The chance of obtaining a loss as a result of known or unforeseen circumstances.**
3	2020	uncertainty	Jaber	**Uncertainty about the outcome of actions and events (positive opportunities or negative threats) and the combination of proBabylonity and effect including perceived significance.**
4	2016	Cumulative effects	Sithipolvanichgul	**The cumulative effect of the proBabylonity of occurrence of uncertain situations that may have a positive or negative impact on the objectives of the economic unit.**

Based on what was mentioned earlier, it is evident that risks are unforeseeable variations that can alter their characteristics, influence, and timing over a period of time. Alternatively, they may be anticipated proBabylonities that have the potential to impact the organization, and these consequences can either be favorable or unfavorable towards the company's goals.

1- Types of risks

The classifications of risks that units are exposed to and their potential impact on achieving objectives, resulting in both qualitative and quantitative challenges and losses, differ based on their inherent characteristics. The primary categorization of risks is outlined in the following table, illustrating their varying types:

Table (8): the classification of risks and theirtypes

Risk type	Category
Employment risks human risks Occupational health and safety risks	Person risk

strategic risks Reputational risk Market risk business risk	strategic risks
internal fraud Operation risks Scheduling time and scope risk Damage to physical assets incorrect data	Operational risks
accounting risks Liquidity risk credit risk	financial risks
system failure technical risks Technical risks environmental risks	technological risks

Source:(Valsecchi,2017, p. 17-2).

2- The costs of environmental risks

Environmental costs are used to measure the cost of damage caused by production or industrial production processes. Therefore, environmental costs determine the amount of money that the community is owed for environmental damage resulting from the activities and industrial operations of the industrial facility (Bebbington & Gray, 2001, p. 128). These costs may extend to include waste disposal costs, air and water conservation, pollution reduction, and the development of primary resources, processes, and production activities that are more environmentally friendly (Nashwan, 2002, p. 65).

Therefore, committing to spending environmental costs in order to clean up pollution sites or to remove environmental damage caused by production processes carried out by the industrial unit is an environmental obligation that must be disclosed in the financial statements and estimated reasonably. This commitment may be a commitment to environmental laws, regulations, and requirements, or it may be an ethical commitment (Al-Yasiri, 2007, p. 5). Environmental risk costs have been defined by many researchers, including those listed in Table (9):

Table (9): Researchers' perspectives on defining the costs of environmental risks

	the definition	definition axis	Year of publication	Author Name
1)	These researchers agreed that environmental costs are burdens and sacrifices (monetary and non-monetary) borne by the economic establishment as a result of its operational activities to prevent or reduce	Burdens and sacrifices to prevent and reduce environmental impacts	2019	**Dwinata**
2)			2017	**Masruhainah**
3)			2016	**Henri et al.,**
4)			2013	**Okaro et al.,**
5)			2012	**Olga et al.,**
6)			2010	**Todea et al.,**
7)			2009	**Ngwakwe**

	environmental damage.			
8)	These researchers considered that environmental costs are amounts spent to comply with environmental laws and their instructions in order to prevent negative impacts on the environment and preserve the environment.	Amounts spent to comply with environmental laws	2019	**Bicer&Eldarewi**
9)			2015	**Saleh**
10)			2014	**Janković &Krivacić**
11)			2011	**Jing&Songqing**
12)			1995	**Spitzer & Elwood**

Source: Prepared by the two researchers based on the above mentioned sources.

Based on the above, it becomes clear that the costs of environmental risks involve recording all the money sacrificed by the unit to prevent or reduce environmental damage. This includes the costs of all activities related to environmental protection as well as all the costs of measuring, monitoring, and correcting the effects of activities that impact the environment. Over the long term and under the standard for converting resources for electronic and electrical equipment, which focuses on preventing environmental damage and pollution to reduce environmental risks, sustainability involves maintaining the product's market sustainability. This requires determining appropriate and accurate standard indicators, which may involve minimizing environmental damage and its effects. However, environmental risks lie in the production phase, which involves using raw materials that carry different types of environmental pollutants that affect the unit's internal and external environment. Environmental effects are treated by using environmentally friendly raw materials to prevent environmental damage. These materials should not contain chemicals or gases that have a significant impact on the environment. In addition, compliance with laws and regulations that restrict the use of environmentally harmful inputs and the environmental risks resulting from the use of the product is essential. Therefore, the process of assessing environmental risks should begin at the research and development stage to design high-quality, environmentally friendly products that do not lead to possible future environmental damage. Attention should also be paid to the quality of the inputs used in the production process and the non-harmful emissions they produce, using inputs that are environmentally friendly and non-harmful. Recycling the product or disposing of it in a way that does not cause environmental damage is crucial. This is what the standard for converting resources focuses on, and the current cost of manufacturing batteries in the Babylon 2 battery factory (the research site) will be discussed. Then, the proposed model for environmental risk management will be applied under the standard for converting resources for electronic and electrical equipment.

3. THE APPLIED SIDE

1- <u>The environmental reality of the battery factory</u>

The factory is classified as Class (A), which includes projects that have significant environmental impacts and affect living organisms. The liquid battery factory has been classified within this category based on the Environmental Guidelines for Project Construction and Implementation Safety Monitoring No. (3) of 2011, Article (5) of the aforementioned guidelines. The factory produces the standard liquid acid battery at Babylon 2 plant, which consists of the following materials and metals:

1. Alloy lead produced by the lead foundry factory, which is used in casting grids and other parts.
2. Pure lead produced by the lead foundry factory, which is used in preparing lead oxide.

3. Other chemical materials used in the production process such as carbon black, barium sulfate, citric acid, and sulfuric acid.
4. Insulating material used to insulate the plates.
5. Plastic used to make boxes, covers, and other plastic parts.
6. Acidic solution representing (35% acid + 65% water).

The production of the battery generates a range of pollutants that vary in density and volume depending on the pollutant. These wastes can be divided into three types as follows:

- Waste gases: these include gases produced during the production process, sulfuric acid vapors, and volatile gas particles such as dust. Liquid pollutants include the liquids resulting from washing plates, cleaning electrodes, and charging byproducts.
- Solid pollutants: these include materials resulting from the damage of some parts or from the breakdown of materials during preparation, especially in the preparation of lead oxide. As a result of these processes, the factory incurs significant costs to dispose of or reduce the environmental effects of the waste generated.

To address environmental risks, efforts will be made in this area to present scenarios for reducing environmental risks by using environmentally friendly and safe materials that do not lead to harmful emissions and pollution in the internal and external environment of the factory and even for customers. These scenarios can be clarified through the following:

The first scenario: Focus on the research and development unit. Given the importance of the research and development unit, which is the basis for continuity and sustainability in the factory, its role revolves around reducing pollution by developing environmentally friendly technologies, equipment, and machines that contribute to reducing environmental impacts, disposing of waste, and reducing costs, especially the costs of raw materials used in battery production. This aims to reduce waste, losses, and damage in production, which will lead to a clear reduction in production costs, including the following:

1- The pursuit of contracting with local or international institutions in research and development to provide scientific research and consulting that contributes to improving the productivity efficiency of the laboratory and reducing waste emissions, as well as training employees in research and development in modern technology to bring changes to the laboratory's product.
2- Encouraging employees to create a spirit of innovation and creativity to strive for increased productivity efficiency and to provide the product with specifications that match similar global standards for the laboratory's product, through providing financial and moral incentives.
3- Involving employees in all units of the factory, especially research and development employees, in professional training courses in each of their specialties to reduce the risks that occur during the production process or to develop the production process in the laboratory to suit the market gap size.
4- Conducting continuous benchmarking with similar products from international and local companies.
5- Purchasing specialized laboratories for research and development operations to conduct research and experiments before the factory begins production of the product.

Second scenario

Treatment of all kinds of Waste

Through inquiries and field observation of the laboratory, it was found that the laboratory needs to design a device for extracting vapors and gases. This device pulls the vapors and dust in the laboratory through a network of pipes that are prepared for this purpose throughout the factory. The air is then passed through a set of filters for purification. These filters are equipped with fans to create air currents that allow the vapors and dust to adhere to the surface of the filters, after which they settle by reducing the pressure by stopping the fans. There is also a device that vibrates the filters, causing the particles to settle to the bottom of the device due to gravity. These particles are then collected and returned to the smelting laboratory for recycling. Although the amounts that are recycled are small and cannot be measured quantitatively or relatively by the laboratory, and cannot be economically relied upon, they are important for removing pollution and avoiding the negative effects of these pollutants on workers and the community surrounding the factory, as shown in the following picture, which illustrates the shape of the hoses and filters used for filtration:

Figure (1): Illustration of air filtration in industrial plants that produce fumes and gases Source:https://aibokeji.en.made-inchina.com/product/RwzfmbMObahl/China-Industrial-Central-Air-Filtration-System-Central-Pulse-Jet-Clean-Cartridge-Dust-Collector-Equipment.html.

A) Treatment of liquid pollutants: Liquid pollutants are represented by water to which sulfuric acid has been added, as indicated in the following table:

Table (10): Calculation of liquid waste for the Babylon plant2 for 2021

Subject	Quantity	Cost
Water	8496 m^3 liters	**977040**

Source: Prepared by the researchers based on the records of the Cost Division in the factory for the year2021.

The above table shows that the amount of water used in Babylon 2 plant was 8496 m^3, while the cost of water was calculated to be Dinar (2512 acid water × 2337 × 115) = (675112560) Dinar. Through field observations and verbal inquiries with the engineers and technicians working in the plant, it was found that this water was significantly diluted for use in the battery charging process with distilled water. The tanks available in the plant are sufficient for this purpose, provided that their returns are redesigned. The percentage of water that can be reused is 65% of the total water quantity, and the sulfuric acid added to the water reacts with it. The cost of the sulfuric acid is estimated at (337) Dinar for each (4×0.628) liter of water = (2512) Dinar, as (4) liters of water are added to each battery after adding the sulfuric acid. Therefore, the cost of chemicals would be (5870544m^3 × 0.001) = (5870.544) Dinar. Therefore, the formula to determine the cost of the water that can be conserved is as follows:

The cost of water that will be provided = (the cost of water used x65% - the cost of chemicals
=(675,112,560 x 65% — 5,870,544
=438823164.65- 5870.544
=438,817,294.106 dinars

Through the above equation, it is apparent that the cost of the water saved, after excluding the cost of the chemicals used, amounts to (5870.544) dinars. The factory can also avoid legal environmental fines by not releasing the water into the sewage system, which can cause hazardous environmental damage, thereby achieving the sustainability goal of preserving the environment. Additionally, the materials deposited in the tanks are collected to be recycled in the lead smelting plant. Through field observations and inquiries from specialists in the plant, it was found that the waste percentage in the liquids was (4%) of the materials used in the production processes. Thus, the cost of liquid waste can be calculated using the following equations:

Battery liquid waste cost = quantities involved in production x percentage of liquid waste
23941x **4% = 958**
In order to obtain the total costs of liquid waste, it is calculated according to the following equation:
Total effluent costs = battery effluent cost x production
958 ×2337 = 2,238,846 dinars

C-Solid pollutant treatment

Through on-site observation at the factory and inquiries, it was found that, according to the records issued by the planning department of the factory, the waste materials produced in the clamps, oxide, and slag unit are estimated to be 2% of the total materials used in the production process, including chemicals. In addition, the plastic material used in the plastic unit, which is the main stage for assembling or collecting battery parts in plastic boxes and rings, is also considered waste if it does not meet the laboratory specifications and is rejected by the quality control department at all production stages, or if it is damaged due to sudden and frequent malfunctions or power outages that occur for up to 4 hours during the production process. It is possible to save on the cost of melting by recycling it again. This interruption results in various rates of damage to the production stages. The following table shows the materials that produce waste in all its forms and the rates of damage in them:

Table (11): Stages, percentages of damage and types of waste

Damage type	Damage rate%	stage
nothing	5% for all stages of production	foundry
solid + gaseous		buckles
solid + gaseous		Oxide and ficus
liquid		Shipping and cutting
Solid		poles
Solid		plastic
Solid		breaks
solid + liquid + gaseous		compilation

Source: prepared by the two researchers based on the field experience and the statements of the Planning Division in the factory for a year2021.

The above table shows a significant amount of solid waste, which reaches a percentage of 5% due to the actual non-normal damage caused by power outages in the factory and the delay in operating the generators. This delay leads to the solidification of lead oxide material in the oxide and paste production stage, causing damage that requires replacement. This problem can be overcome by equipping the lab with an automatic self-start device at a cost of (7,000,000) dinars and a production life of (8) years, which is connected to those generators to avoid power outages. The following diagram illustrates the automatic self-start device:

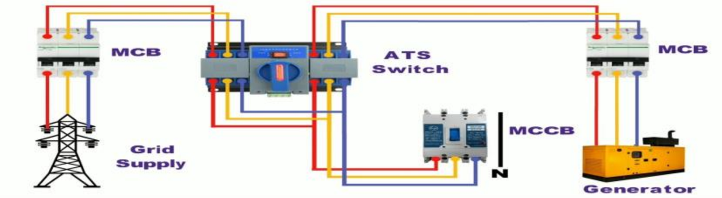

Figure (2): Illustration of an automation device

Source; https://www.youtube.com/watch?v=Jg7iByLjTJM

The costs of unacceptable damage are calculated as follows:

1- The cost of the materials used in the clamps, oxide, and paste production stage is calculated using the following equation:

Material cost = lead + different materials
=7710.38 + 13111
= 20821.38

2- Calculating the total cost of damage: The cost can be calculated through the following table:

Table (12) Calculate the total cost of damage

Total damage costs5=(3×4)	Number of batteries produced for a year2021(4)	Cost of damaged materials per battery3=(1×2)	spoilage rate (2)	total costs (1)
2432978.253	2337	1,041,069	5%	20821.38

Source: prepared by the researcher based on the records of the Costs Division in the factory for one year2021.

3- Comparing it with the device's depreciation cost, which is calculated using the straight-line method, according to the following equation:

÷ 7000000 8 = 875000

If the company purchased this device at an annual cost of (875000) dinars, which will reduce the damage amounting to (2432978.253) dinars annually, estimated at a rate of (5%), this leads to a decrease in waste, improving energy efficiency, and utilizing resources more optimally. This is what sustainability accounting standards aim for, particularly the resource conversion standard for electrical and electronic equipment, which can be clarified in Table (57) below:

Table (13): The costs that will be saved if the device is used

	Amount / dinars	The details
1	2432978.253	**The total cost of damaged batteries**
2	875,000	**The cost of recovering the automation device**
	1557978.253	**What we will get in cost savings annually**

Source: The researchers prepared the report based on the cost records of the factory's cost department for the year 2021.

From the above table, it is clear that if the company purchases the automatic device at a cost of (7,000,000) dinars, it will save (1,557,978.253) dinars, reducing the damage caused by (5%) in the clamps, oxide, and lump stages and improving the quality of the product. This will spare the factory additional costs for waste disposal or recycling and the accompanying harmful emissions and environmental pollutants. To calculate the cost of solid waste, the materials used in production must be multiplied by the percentage of waste generated from the production processes, especially in the second and third stages of the battery life cycle, as they consume solid materials that produce solid waste. It has been found that the percentage of solid waste is (2%) of the materials used in production, and it can be calculated using the following equations:

The cost of materials involved in production = lead of all kinds + various materials + plastic
=7710.38 + 13111 +1595.167 = 22416.547
Battery solid waste cost = cost of materials used in production× (2%)
22,416,547 × 2% = 448.33094
Total Solid Waste Cost = Battery Solid Waste Cost× Production quantity for the year 2021
448.33094 x 2337 = 1047749.40678 dinars

Through the equations above, it is apparent that the cost of the materials used in production depends on the clamps, oxide, lump, and plastic units because they contain solid, chemical, and plastic materials, with a total cost of (22,416.547) dinars. Meanwhile, the cost of solid waste for each battery was (448.33094) dinars, and the total cost of solid waste generated from the production process was (1,047,749.40678) dinars. These figures can be illustrated in the following

table: (14): Calculating the amounts spent on waste reuse and the costs saved

The details	Costs (amounts in dinars)
Liquid waste costs saved	**2238846**
Solid waste costs saved	**1047749.40678**
Total waste costs	**3286595.40678**
Waste treatment costs80% of the total waste costs	**2629276.325424**
Costs that cannot be addressed (20%	**657319.081356**
Costs saved from purchasing recycled batteries (number2880 tons (80%)	**495,360,000**
Costs that cannot be remedied from purchasingrecycled batteries Number (2880 tons (20%)	**123,840,000**
The costs of the batteries returned from the factory to the lead foundry amounted to (24) Battery x Battery Production Cost = 24 x 33457 = 802968 x 802968 x 80% = 6423744	**6423744**
	1605936

Source: prepared by the researchers based on factory records for the year2021.

From the above table, it is evident that the total cost savings for liquid waste amounted to 2,238,846 dinars, while the total cost savings for solid waste amounted to 1,047,749.40678 dinars. Upon inquiry with the engineers and technicians working in the recycling plant, it was found that 80% of the materials that could be utilized, while the remaining percentage is sold in the markets based on public auction pricing.

It should be noted that the quantity of consumed batteries purchased during the year 2021 was 2,880 tons at a cost of 215,000 dinars per ton, totaling 619,200,000 dinars. These batteries were sent to the lead smelter plant for recycling, and as mentioned earlier, 80% of the batteries or recycled materials can be utilized, and the remaining percentage is sold in public auctions. The recycling of 2,880 tons of batteries will provide 2,304 tons of materials and metals that can be used in the production process, resulting in cost savings of 495,360,000 dinars in the year 2021.

In addition to the recycled batteries, 24 batteries were also returned to the recycling plant, at a cost of 802,968 dinars, and 80% of the materials used in producing those batteries can be recovered, resulting in cost savings. The remaining percentage will be sold in the markets and priced through public auctions, providing additional revenue for the plant.

After considering the scenarios and the cost savings and reduction of environmental risks, the indicators that the standard for converting resources to electrical and electronic equipment will be discussed to promote those proposals and achieve the research objective of reducing environmental risks for products. The indicators and measures included in the standard for converting resources for electrical and electronic equipment, which specialize in reducing environmental risks, will be discussed as follows:

Product safety according to the standard for converting resources for electrical and electronic equipment

The laboratory can improve product safety performance through the following proposals:

Firstly - the first proposal is to focus on the research and development unit

Secondly - the second proposal is related to the treatment of all types of waste.

1- Hazardous waste management according to the standard of conversionring resources to electrical and electronic equipment.

Table (15): Calculation of hazardous waste management according to the hazardous waste management scale of the resource conversion standard for electrical and electronic equipment

The number and total quantity of leaks reported and the quantity returned		**percentage according to the standard** $\frac{\text{weight of recycled hazardous waste materials}}{\text{total weight of hazardous waste}} \times 100$	**waste type**
costs that cannot be addressed	costs that can be addressed		
657319.081356	2629276.325424	2238846÷3286595.40678=68%	**Liquid**
		1047749.40678÷3286595.40678=32%	**Solid**
3286595.40678		100%	**the total**

Source: Researchers based on factory records for the year 2021, and the metrics were hazardous waste management for the WEEE (Waste Electrical and Electronic Equipment) conversion standard.

From the above table, it is apparent that the percentage of hazardous liquid waste is higher than the percentage of hazardous solid waste, as shown by the indicators in the table. The percentage of liquid waste reached (68%), while the percentage of hazardous solid waste was (32%). Additionally, the costs that can be treated and recycled amounted to (2629276.325424) dinars out of the total costs for both types of waste (liquid and solid), and the costs of waste that cannot be treated amounted to (657319.081356) dinars (according to the experts in the laboratory, they are sold in public auctions). Furthermore, there are emissions and gases that cannot be measured quantitatively or proportionally, and they are treated according to scenario (2/A) for gas waste treatment.

2- Sources of materials according to the WEEE conversion standard.

Table (16): Cost ratios of products that contain critical materials

Activity or unit	**Material cost ratio for products that contain critical materials** $\frac{\text{Cost of materials containing critical materials}}{\text{The total cost of raw materials}} \times 100$
research and development the design engineering inspection quality control	**At this stage there are no raw materials containing critical materials**
foundry	$\frac{(9.38+5107+2594)}{23940.921} \times 100 = 32\%$
Synapses and ficus oxalis	$\frac{(133+1066+3264+998+488+1010+377+2431+465+931+24+1924)}{23940.921} \times 100$ $\frac{13101}{23940.921} \times 100 = 55\%$
for charging and chipping	$\frac{255.667+163.64+93}{23940.921} \times 100 = 2\%$
poles	$\frac{67\times2=134}{23940.921} \times 100 = 0.0005$
plastic	$\frac{1154+332+(9.167\times6)+37+30+96}{23940.921} \times 100 = 7\%$
insulators	$\frac{37.067\times30}{23940.921} \times 100 = 5\%$
compilation	**There are no critical raw materials only identification labels for the packaging and marketing stages of the battery**
Packaging	**0**
Marketing	**0**

recycled batteries	**In this unit, the batteries in it are returned through Technician E containing the same proportions as those in the aforementioned units**
Recycling	**There are no critical materials and the work of this unit is to recycle the same resources that produced or contributed to the production of the battery in the previous production units**

Source: Prepared by the researchers based on the factory records for the year 2021.

From the table above, it is evident that the ratios of critical material costs to total raw material costs are concentrated in the units of networks, oxide, and slag, with a percentage of (55%) followed by the lead smelting laboratory unit, which produces lead in all its types used in the production process, with a percentage of (32%). Meanwhile, the ratios were lowest in the use of critical materials in the battery production process, namely plastic units, insulators, charging and cutting units, and electrodes, with percentages of (7%, 5%, 2%, 0.0005%), respectively.

The researcher believes that relying on sustainability accounting standards, especially the standard for converting resources into electrical and electronic equipment by the company for the purpose of reducing environmental risks, and based on the information in the research, it is proven that the sustainability accounting standard (the standard for converting resources into electrical and electronic equipment) contributes to reducing environmental risks, which in turn reflects on the external environment of the factory and on the community to achieve the main dimensions of sustainability (economic, environmental, and social).

4. CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusions

This section discusses the most important conclusions reached by the researcher, as outlined below:

1) The criterion for converting resources into electrical and electronic equipment will contribute to reducing the environmental risks associated with products.
2) Applying sustainability accounting standards, especially the criterion for converting resources into electrical and electronic equipment, will help manage hazardous waste (liquid and solid) to preserve the environment and reduce environmental risks.
3) Focusing on research and development, as well as waste processing in all its forms, will contribute to maintaining product safety.
4) Power outages in the factory and delayed generator operation, which leads to lead oxide hardening in the oxide and paste stage, will damage the equipment and require overcoming and avoiding this problem by equipping the laboratory with an automatic operating device.
5) Redesigning returns in liquid waste through the basins in the laboratory will help avoid environmental legal fines and preserve the environment.
6) Designing a device to extract vapors and gases to treat gaseous, liquid, and solid waste for the purpose of air purification and protecting workers from injuries.

4.2 Recommendations

After addressing the most important conclusions of the current study, the researcher would like to present recommendations as a modest contribution to the factory (the research sample) and to industrial companies in general, which can be beneficial in the future. These recommendations are as follows:

1. The company should adopt the standard of converting resources for electrical and electronic equipment to reduce product costs and environmental risks.
2. The company should apply sustainability accounting standards, particularly the standard of converting resources to electrical and electronic equipment, to maintain sustainability dimensions (environmental and social) and reduce environmental risks.
3. The company should prioritize its research and development unit to provide modern equipment and machines that are environmentally friendly, as well as waste treatment of all kinds.
4. The company should ensure that it continues to provide electrical energy to the factory to prevent the solidification of lead oxide and avoid incurring additional costs.

5. The company must recycle liquid waste returns to avoid any environmental legal fines.
6. The company should design a device to remove fumes and gases to treat waste, purify the air, and ensure the safety of workers.

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