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Assignment - Test 4

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Environmental Studies (SCR353)

Assignment - Test - 4

Q.1. What is e-waste? What is the wheel of life of E-waste? Explain the concept of Business Model.

Answer of Q. No. 1.

E-lectronic Waste

- Electronic Waste, also recognized as E-waste, is a combination of used or unwanted electronic products that have exceeded their shelf life.
- E-waste is any electrical or electronic equipment that's been discarded. This includes working and broken items that are thrown in the garbage or donated to a charity reseller like Goodwill. Often if the item goes unsold in the store, it will be thrown away. E-waste is particularly dangerous due to toxic chemicals that naturally leach from the metals inside when buried. Computer equipment, monitors / TV's, cell phones, batteries, stereos, etc. are popular examples of items that contain harmful toxic components that need to be recycled properly.
- "Electronic waste accounts for 2 percent of America's trash in landfills but 70 percent of its toxic garbage.
- In 2003 alone, 3 million tons of e-waste were generated in the United States."
- Although e-waste contains complex combinations of highly toxic substances that pose a danger to health and the environment.

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E-waste "Wheel of Life"

On the e-waste "Wheel of Life"

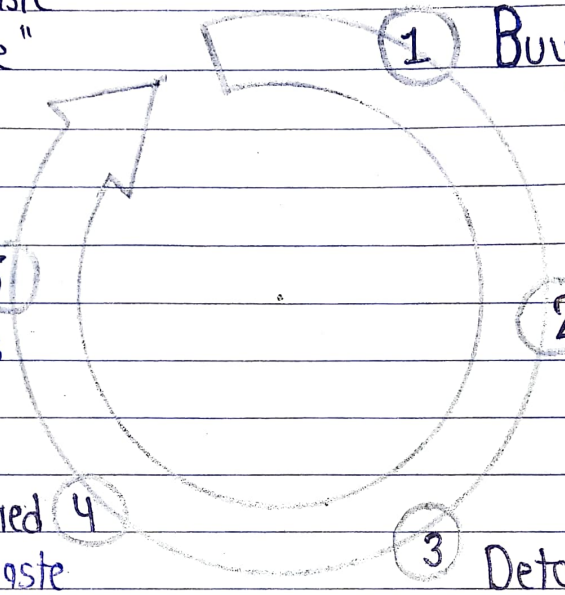

Figure 1.1 : "Wheel of Life" E-waste

1. Buy :

- "Buy new Items" is the 1st stage in the wheel. Consumers go out and purchase electronic devices.

2. Return

- The 2nd stage in this "wheel of life" is returning end-of-life appliances or Waste Electrical and Electronic Equipment (WEEE). Consumers are not allowed to dispose of WEEE through other than dedicated collection points. Fees might be applicable for certain wastes.
- For instance, if a retailer only sells Dell computers, they must still take back HP computers, but not necessarily refrigerators.

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3. Detox

- The 3rd phase involves "Detoxification" - the removal of critical components from the e-waste in order to avoid dilution of and/or contamination with toxic substances. This work requires much manual labor and thus is unprofitable considering Swiss wages.
- Most of the costs and often this manual processes are outsourced by the large recyclers to nearby social institutions.

4. Shred

- The 4th stage involves the shreeding of like materials so they can be prepared for refinement.

5. Refine

- The 5th and the final stage, is refinement, where most of the fractions need to be refined or conditioned in order to be sold as secondary raw materials or to be disposed of in a final disposal site, respectively. Many refining processes take place outside Switzerland, entailing greater ~~support~~ transport distances.
- The refining process focuses on three main materials: metal, plastic, and glass.

- Due to economies of scale, specialization and division of labor such large installations aren't needed in every country. For example, the refinery of Umicore in Belgium is made up of two main processes: The

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precious metal operations and the base metal operations.

Business Model

- Business model evolves from recycling industry operating under policy and regulator framework in a country. It follow a loose business model.
- Lots of competition, more than 500 collectors in state of California, more than 50 recyclers in the state.
- If they can't serve a customer recycling e-waste, they refer them to a reputable competitor who can dispose of the waste properly.
- Provide the recycling service for Free, to increase customers awareness and to ensure waste is not thrown away in the garbage.
- Must be a resident of the state of California.
- Most of their revenue is generated from the recycling of CRT monitors, because the state of California offers a subsidy for each pound of glass recycled, they receive additional revenue from the government.
- Waste that cannot be processed, is shipped and sold to a respective recycler who will dispose of the materials properly.
- A work force of 27 employees, handles the everyday operations of the company.
- It is important to have proper e-waste management. E-waste now represents over 70% of all environmental emissions.

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Q.2. Explain Classification of E-waste i.e. both (Compositions & Components) of E-waste.

Answer of Q. No. 2

Classification of E-waste

E-waste can be classified on the basis of its composition and components. Ferrous and nonferrous metal, glass, plastics, pollutants, and other are the six categories of materials reported for e-waste compositions.

Composition of E-waste

- Composition of e-waste is very diverse and differs in products across different categories. It contains more than 1000 different substances, which fall under "hazardous" and "non-hazardous" categories. Broadly, it consists of ferrous and non-ferrous metals, plastics, glass, wood & plywood, printed circuit boards, concrete and ceramics, rubber and other items.
- Iron and Steel constitutes about 50% of the e-waste followed by plastics (21%), non-ferrous metals (13%) and other constituents.
- Non-ferrous metals consists of metal like copper, aluminium and precious metals ex. silver, gold, platinum, palladium etc.
- The presence of elements like lead, mercury, arsenic, cadmium, selenium and hexavalent chromium and flame retardants beyond threshold quantities in e-waste classifies them as hazardous waste.

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Components of E-waste

- E-waste has been categorized into three main categories, Viz. Large Household Appliances, IT and Telecom and Consumer Equipment.
- Refrigerators and Washing Machine represents large household appliances, Personal Computer, Monitor and Laptop represents IT and Telecom while Television represents Consumer Equipment.

- Each of these E-waste items has been classified with respect to twenty & six common components, which could be found in them. These components form the "Building Blocks" of each item and therefore they are readily "identifiable" and "removable".

- These components are metal, motor / compressor, cooling, plastic, insulation, glass, LCD, rubber, wiring / electrical, concrete, transformer, magnetron, textile, circuit board, fluorescent lamp, incandescent lamp, heating element, thermostat, BFR-containing plastic, batteries, CFC/HCFC/HFC/HC, external electric cables, refractory ceramic fibers, radio active substances and electrolyte capacitors (over LID 25 mm).

1. Radioactive substances, refractory ceramic fibers, electrolyte capacitors (over LID 25 mm), textile and magnetron are not present in any item.

2. Plastic, circuit board and external electric cables are present in majority of items. BFR containing plastic

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is present in refrigerator, laptop and television.

3. Refrigerators are unique items because of presence of CFC/HCFC/HFC/HC, cooling, insulation, incandescent lamp and compressor.

4. Heating element is found in washing machine, while thermostat is found in both refrigerator and washing machine.

5. Fluorescent lamp is found only in laptop.

6. Metal and motor are found in majority of items except refrigerator.

7. Transformer is not found in washing machine and refrigerator.

8. CRT is found in personal computer and TV, while LCD is found in PC and TV.

9. Batteries are found in PC and laptop.

10. Concrete is found in washing machine.

11. Rubber is found in refrigerator and washing machine.

12. Wiring / Electrical is found in all the items.

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Large household appliance (refrigerator) may consist of electric motor, a circuit board, a transformer, capacitor, thermal insulation, switches, wiring, plastic casing that contains flames retardants etc.

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Q.3. Explain case study of Bridgestone that was discussed in the class room.

Answer of Q. No-3

Bridgestone corporation is global leader and the largest manufacturer of tyres and other rubber products.
It is a multinational establishment known for its auto and truck parts espacially tyres.

World wide it has many plants. In India, it has numerous customers as well it has a plant in Pithampur near Indore.

This case study is around the time 1994-95. The company's mission has always been "serving society with superior quality".
Customers satisfaction and brand value is very important to company and its brand value.

They promised that their tyre will run around 40,000 km without any wear and tear.

They manufactured their first batch of around 10,000 tyres.
When they sent it for testing, they found that their tyres are running only 20000 kms.

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Now they had several options.

→ They could sell their tyres normally acting as if there's nothing wrong. But that would not only be normally wrong, it would reduce their brand value and disappoint their customers too.

→ They could reveal that their tyres are 20,000 kms working and still at a reasonable cost but that would harm their brand value and lose its authenticity.

→ They could sell their tyres to dealers without brand name. But this would mean loss of investors.

→ They could sell tyres at low cost. But dealers and middlemen will take away profit margin and at the end customers will be at loss.

→ They could sell directly to the customers but that would difinitely upset the dealers.

→ They could take the high way and recycle the entire batch and start from scratch.

All the early options can be economically profitable but in longer game it would affect their brand.
The last option, will maintain their integrity and

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value, but would call serve economic loss.

The company choose the latter option put their money at stake and recycled the entire batch.
The new batch was made. When tested this batch gave 25000 km results.

The company recycled all over again. They reached 30,000. Recycled again and than the reached 38,000. Although, the different was only of 2,000 km the margin should be of ± 1%, i.e between 39600 and 40,400.

They recycled again and this time they reached 50,000. This was a super good news. But if this batch was released customers will have high expectations and when actual promised value will be released, they would be disappointed and reject the brand.

They recycled again and reached their 40,000 mark and sold it ~~to~~.

The conclusion was that for a sustainable and successful company, customer satisfaction is very important and a company should set their promised value for a long term success.
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Q.4. Explain The Hazardous Wastes (Management and Handling) Rules, 2003.

Answer of Q. No. 4

The Hazardous Wastes (Management and Handling)

The Hazardous Wastes (Management and Handling) Rule, 2003, defines "hazardous waste" as any waste which by reason of any of its physical, chemical, reactive, toxic, flammable, explosive or corrosive characteristics causes danger or likely to cause danger to health or environment, whether alone or when on contact with other wastes or substances, and shall include:

Waste substances that are generated in the 36 processes indicated in column 2 of Schedule I and consist of wholly or partly of the waste substances referred to in column 3 of same schedule.
Waste substances that consist wholly or partly of substances indicated in five risk class (A, B, C, D, E) mentioned in Schedule 2, unless the concentration of substances is less than the limit indicated in the same Schedule.
Waste substances that are indicated in Lists A and B of Schedule 3 (Part A) applicable only in cases of import and export of hazardous wastes in accordance with rules 12, 13 and 14 if they possess any of the hazardous characteristics listed in Part B of Schedule 3.

"Disposal" means deposit, treatment, recycling and recovery of any hazardous wastes.

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Important features of Schedule 1, 2 and 3, which may cover E-wastes are given below.

Schedule 1

Although, there is no direct reference of electronic waste in any column of Schedule 1 (which defines hazardous waste generated through different industrial processes), the "disposal process" of e-waste could be ~~cate~~ characterized as hazardous processes. The indicative list of the these processes is given below.

- Secondary production and/or use of Zinc.
- Secondary production of copper.
- Secondary production of lead.
- Production and/or use of cadmium and arsenic and their compounds.
- Production of primary and secondary aluminum.
- Production of iron and steel including other ferrous alloys (electric furnaces, steel rolling and finishing mills, coke oven and by product plan).
- Production or industrial use of materials made with organo silicon compounds.
- Electronic industry
- Waste treatment processes e.g. incineration, distillation, separation and concentration techniques.

As per these regulations, once a waste product is classified as hazardous according to industrial process listed in Schedule 1, it is exempted from the concentration limit requirements set by Schedule 2 of Act, and is considered hazardous irrespective of its concentrations.

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Schedule 2

The Schedule 2 of the Hazardous Waste Management and Handling Rules 2003, lists waste substances which should be considered hazardous unless their concentration is less than the limit indicated in the said Schedule. The various classes of substances listed in this Schedule relevant to E-waste are covered in Class A, B, C, D and E ~~are~~ E-waste or its fractions coming broadly under Class A and B are given below.

- **Class A : Concentration Limit :>= 50 mg/kg**

The indicative waste list, which could be part of E-waste or its fractions under this class are given below.

- Antimony and antimony compounds
- Beryllium and beryllium compounds
- Cadmium and cadmium compounds
- Chromium (VI) compounds
- Mercury and mercury compounds
- Halogenated compounds of aromatic rings, e.g. polychlorinated biphenyls, polychloroteriphenyls and their derivatives.
- Halogenated aromatic compounds

Class B : Concentration Limit :>= 5,000 mg/kg

The indicative waste list, which could be part of E-waste or its fractions under this class are given below.

- Cobalt compounds
- Copper compounds
- Lead and lead compounds
- Nickel compounds
- Inorganic tin compounds
- Vanadium compounds
- Tungsten compounds
- Silver compounds
- Halogenated aliphatic compounds
- Phenol and phenolic compounds
- Chlorine
- Bromine
- Halogen-containing compounds, which produce acidic vapors on contact with humid air or water.

Schedule 3

List of Hazardous Waste to be applicable only for imports and exports are mentioned in schedule 3. It define hazardous waste as "Wastes listed in lists 'A' and 'B' of part A of schedule 3 applicable only in case(s) of export/import of hazardous wastes in accordance with rule 12, 13, and 14 only if they possess any of the hazardous characteristics in part B of said schedule". This clause defines hazardous waste for the purpose of import and export. It has divided hazardous waste into two parts, A and B. Part A of the schedule deals with two lists of waste to be applicable only for imports and exports purpose. Export and import of items listed in List A and B of part A are permitted only as raw materials for recycling or reuse.

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Lists of wastes applicable for Import and Export

Following are the electronic items being mentioned in list A:

- A1180 Electrical and electronic assemblies or scraps containing components.
- A1090 Ashes from the incineration of insulated copper wire.
- A1150 Precious metal ash from incineration of PCBs not included on list 'B'
- A2010 Glass waste from cathode ray tubes and other activated glass.
- A3180 Wastes, substances and articles

Following are electronic items placed on list B B1110:

- Electronic assemblies consisting only of metals or alloys.
- Waste Electrical and Electronics assemblies scrap destined for direct reuse and not for recycling or final disposal.
- Waste electrical and electronic assemblies scrap (including printed circuit boards) not containing components such as accumulators and other batteries included on list A, mercury switches, glass from cathode ray tubes and other activated glass and PCB-capacitors, or not contaminated with constituents such as cadmium, mercury, lead, polychlorinated biphenyl) or from which these have been removed, to an extent that they do not possess any of the constituents mentioned in Schedule 2 to the extent of concentration limits specified therein.
- Electrical and electronic assemblies (including printed circuit boards, electronic components and wires) destined for direct reuse and not for recycling or final disposal.

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Q.5 Explain fundamentals of E-waste recycling markets for recycling technology applications of a "Technology Transfer Framework".

Answer of Q. No. 5

There are certain fundamentals of E-waste recycling markets for recycling technology applications of a "Technology Transfer Framework".

The framework for Analysis :

This focuses to formulate the first step of a strategic technology transfer programme for sustainable e-waste recycling technologies. This address climate change and builds a technology by :

- The first step includes selection of the most promising e-waste recycling technology which will help in creation of a sustainable recycling sector.
- The second step includes identification of 2 possible targets countries. These countries would introduce sustainable e-waste recycling technology by applying UNEP technology transfer framework.
- The third step includes identification of potential barriers and possible interventions which will support the idea of technology transfer.

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- Then, an e-waste recycling chain is formed which is further divided into three steps. These steps are:
  - → Collection
  - → Dismantling & pre-processing
  - → End processing for metal recovery.

- Once the collection phase is over, the appliances which have reached end of life are separated into components while are to be reused or recycled.

- There are certain products which are highly toxic in nature and can thus neither be reused or recycled. These products are then sent to suitable disposal site.

- The third step is then further divided according to their use so that we can achieve an attractive economic results without compromising. In our environment's current state. The steps are divided as:
  - → Taking care of these toxic substances in a manner that is environmentally sound.
  - → Recover components & ~~pro~~ fraction so that it is economically beneficial.

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- The complete treatment of e-waste is then conducted various factors in mind. Equipments available, treatment technologies available socio-economic boundary conditions and legislative requirements.

- The technologies are then divided according to mutual, i.e, ICT equipment, appliances, monitors / TV's and their environmental or economical reference.

- PWBs, and small electronic devices also have dep economic impact due to metals used in them.

- Metallic fractions are the divided into 2 parts one containing precious metals & one without it. These might includes:

  Al: Aluminium for economic and environmental reasons

  Ferrous Metals: Iron, its alloys also have their economic reasons & are used in cooling & freezing appliances.

  Glass (CRT): They are connected to use in lead.

This is the flowchart for e-waste management policy.

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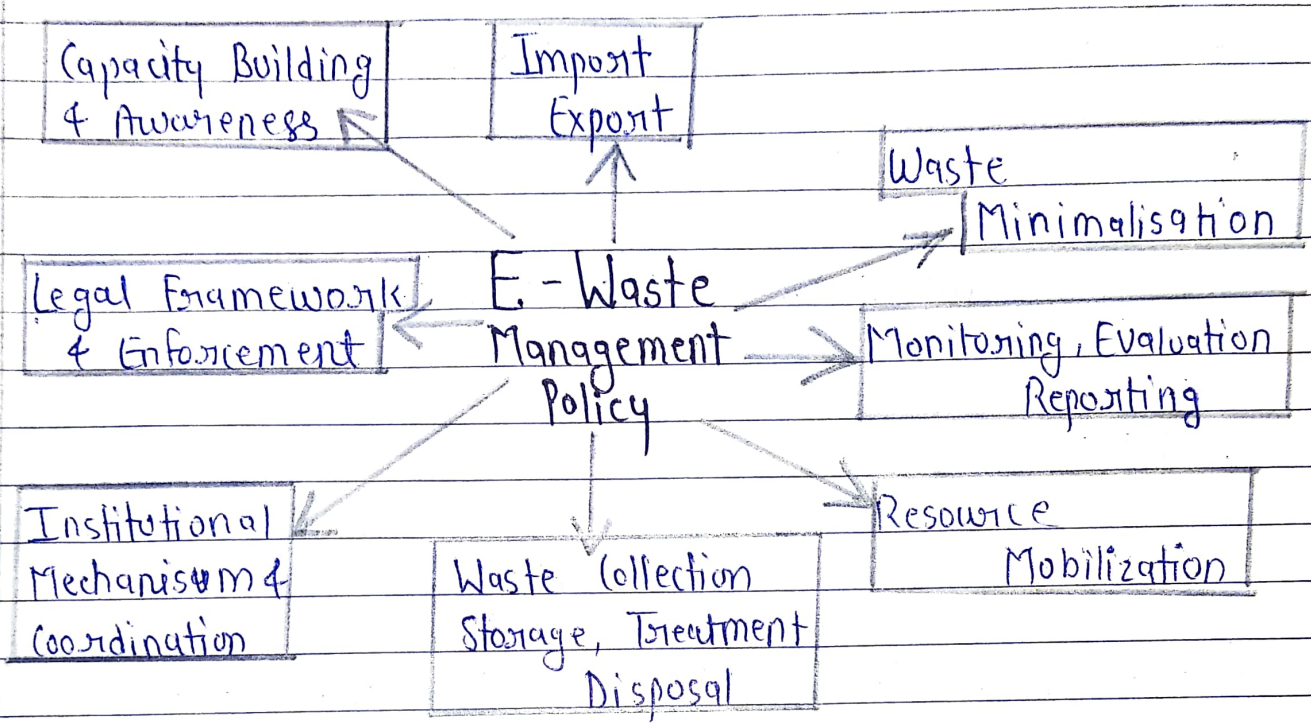

Figure 5.1 : Flowchart of E-Waste Management Policy

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Q.6. What goals are set for E-waste Management, explain any four on the basis of present situation, possible actions, what is needed & results are depending on?

Answer of Q. No. 6

Goals of E-Waste Management

Goal 1 : Producers collect and recycle discarded appliances as well as provide necessary funding (implementing EPR)

Present Situation	Possible Actions	What is Needed	Results are Depending On
High costs of compliance and lack of regulation does not create favourable conditions for producers to accept EPR.	Imposing responsibilities expressed into targets to be achieved by producers.	Legislation and enforcement have to encourage producers to accept responsibilities and assist producers to achieve targets.	The willingness of producers to accept responsibilities
	Ensuring that all producers contribute to e-waste management equally.	EPR must be affordable; costs have to be proportionate to its purpose.	The presence of sanctions in case producers fail to achieve their targets.
	Generate information on collecting and recycling of e-waste.	Targets have be stated smart.	

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No reliable information on collection and recycling of e-waste	Generate information on collecting and recycling of e-waste	Producers have to (be able to) provide reliable information on e-waste collected and recycled.	Availability of means to weigh and record waste.
			Proper information technology.
Responsibilities are likely to be ~~achie~~ evaded.	Implementing effective EPR instruments and e-waste legislation.	Monitoring responsibilities must take manageable effort for administration and enforcement	The extent to which legislation and enforcement is helping producers to meet targets.
	Assessing and if required adapting instruments and legislation.		Effectiveness of monitoring by government.

Goal 2 : All producers own up responsibility and contribute to e-waste management.

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Present Situation	Possible Actions	What is Needed	Results are depending on
Little understanding of producers and the numbers of appliances put on the market.	Introducing a system to register new appliances, how producers fulfill their obligations, and to evaluate results.	Monitoring and enforcement must require manageable effort from the government.	The presence of a register in which all producers of appliances are recorded as well as how each producer complies with obligations.
		Producers have to provide reliable information on products put on the market as well as e-waste collected and recycled.	

Goal 3 : Sufficient funding available for collecting and recycling.

Present Situation	Possible Actions	What is Needed	Results are Depending On
Only e-waste with sufficient resale value is collected and recycled.	Fund the collection and recycling of all types of e-waste, particularly kinds with hazardous materials.	Funding must be transparent and information made available to the public.	Willingness of consumer and/or producer to pay a fee.

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Prices do not take environmentally sound processing into account.		Funds must be sufficient, yet not be excessive and strictly limited its purpose. Direct access of producers to funds should be made impossible. Funding must be monitored by public bodies	Legislation implemented by government to regulate funding.

Goal 4 : Awareness among citizens regarding toxicity and hazards of improper e-waste disposal.

Present Situation	Possible Actions	What is Needed	Results are Depending On
Insufficient knowledge of the environmental impact and health risks of handling e-waste.	Selecting a party responsible for creating awareness (either government and producers).	Use of various types of media to ensure that all layers of the population understand the message.	Effiveness of the message and the chosen media.
Disposal of appliances is driven by the value of the materials only.	Setting measurable goals.	Smart targets to be achieved must be set by government.	Availability of financial resources.