Printed Electronics Helix Launch Event

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REFORM

Crowdhelix
COLLABORATION INTELLIGENCE

Environmental Impact

1. Materials & Manufacturing

Printed Electronics

- Materials: Conductive inks can be up to 98% metal with minimal waste during production
- Manufacturing: Roll-to-roll printing processes for flexible electronics can be up to 99% more energy-efficient compared to traditional silicon-based manufacturing methods.
- Study by U.S. Department of Energy found that roll-to-roll printing consumes 0.05 kWh/m^2, whereas silicon wafer processing requires over 1200 kWh/m^2.

Conventional Electronics

- Materials: Production of **a single** silicon wafer can require ~500 kilograms of silicon and up to 5,000 liters of ultrapure water
- Manufacturing: A typical advanced fab can use between 20 to 40 megawatt-hours per day (~as much as a small town)

Environmental Impact

Printed Electronics	Conventional Electronics
2. Energy Efficiency	
• Energy-efficient designs: Printed electronics can operate on extremely low power. e-paper displays used in e-readers can operate on just a ~1-9 mW.	• High-performance applications: High-end graphics cards for gaming laptops can consume up to 150 watts of power, while data centers with servers can consume MWs of power.
• Lightweight: Flexible solar panels can have efficiency rates of around 10-20% and can weigh as little as 0.1 kg/m^2	• Efforts: Modern laptop processors are designed to operate efficiently, with some using as little as 5-10 watts during typical use.
3. Waste Reduction	
• Precise material deposition: Printing processes can achieve material utilization rates of >95%	• E-waste challenge: In 2019, the world generated approximately 53.6 million metric tons of electronic waste (e-waste), and only about 17.4% of that was documented as properly collected and recycled, according to the Global E-Waste Monitor
• Flexible and disposable: Thin and lightweight printed electronics can reduce the volume of material needed	

Environmental Impact

Printed Electronics	Conventional Electronics
4. Lifecycle Considerations	
• Lifespan: The lifespan of printed electronics varies by application (1-10 years)	• Lifespan: Consumer electronics, on average, have shorter lifespans. Smartphones are typically replaced every 2-3 years, contributing to e-waste.
• Recycling rates: The recycling rate <than for traditional electronics, with focus on recovering valuable materials.	• Recycling rates: The recycling rate for consumer electronics varies by region, but globally it remains relatively low, with significant room for improvement.
5. Chemical Use	
• Chemicals in inks: The chemicals used in conductive inks can vary, but there is a growing effort to develop eco-friendly inks with reduced environmental impact	• Hazardous chemicals: Semiconductor manufacturing involves the use of hazardous chemicals and gases, such as arsenic, phosphine, and various photoresist chemicals.
• Eco-friendly options: Manufacturers are actively working on ink formulations that contain fewer hazardous materials.	• Eco-friendly initiatives: Semiconductor companies are investing in cleaner manufacturing processes, including green chemistry and reduced chemical usage.

Environmental Impact

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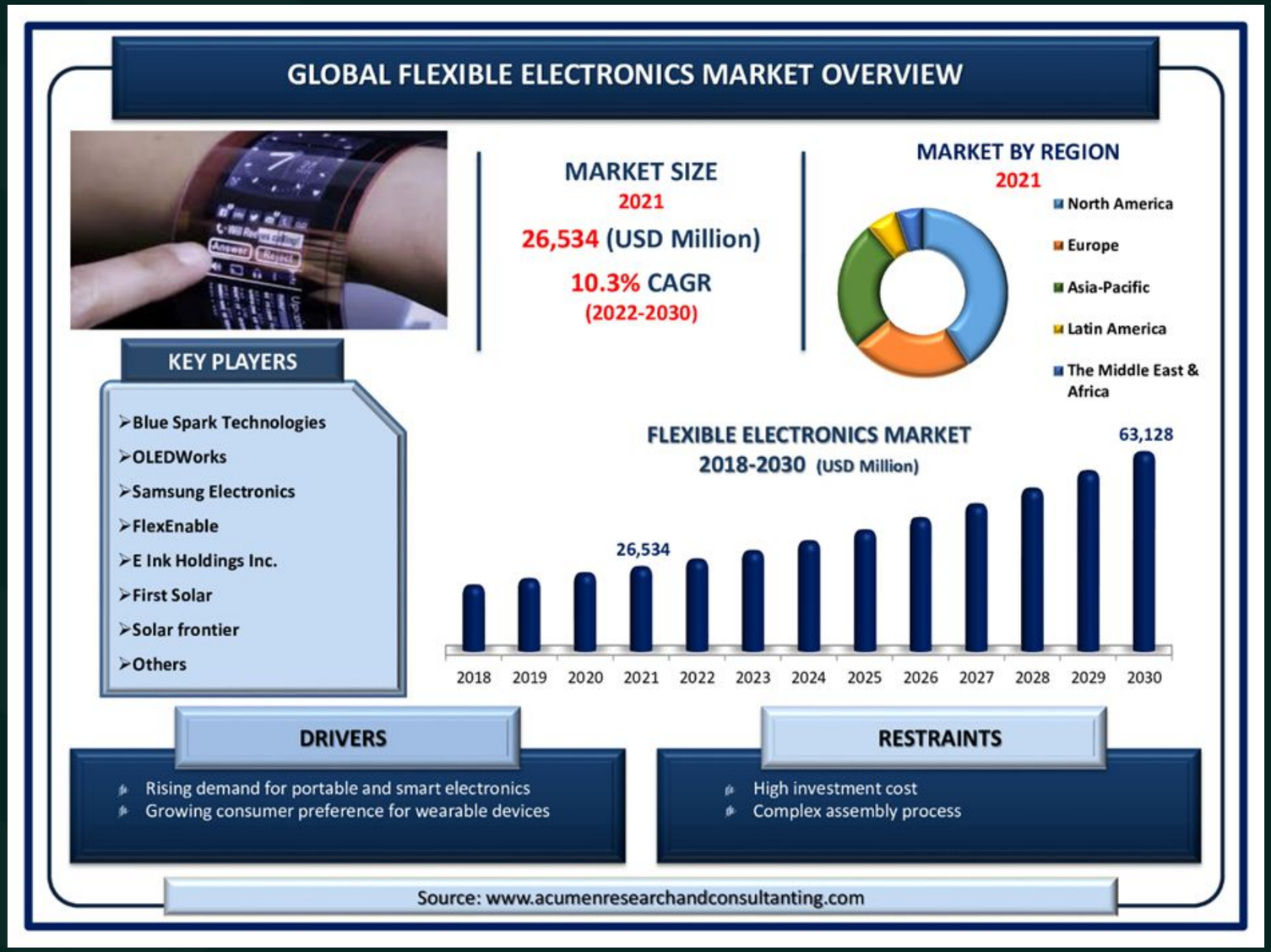
Market Trends



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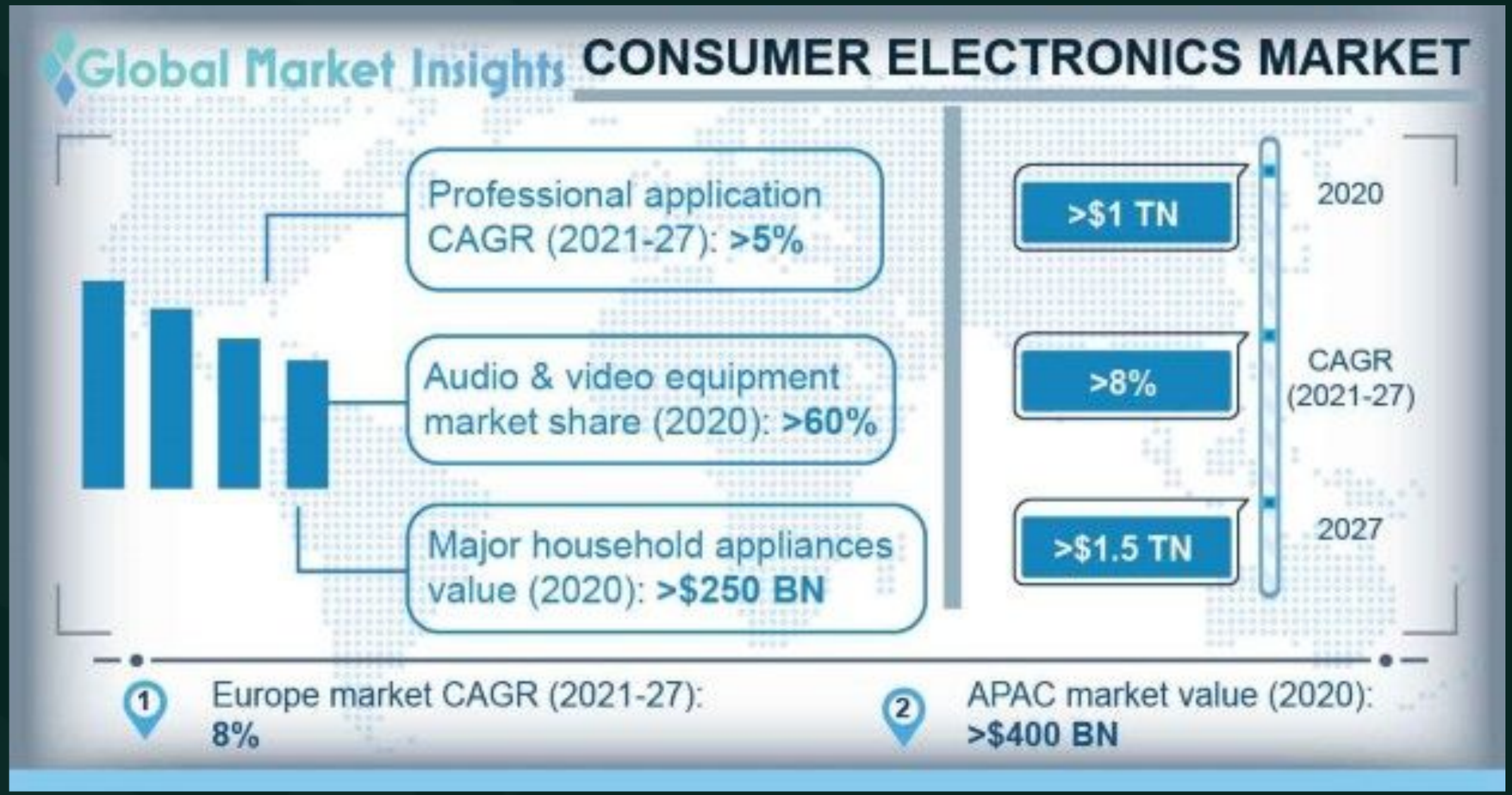
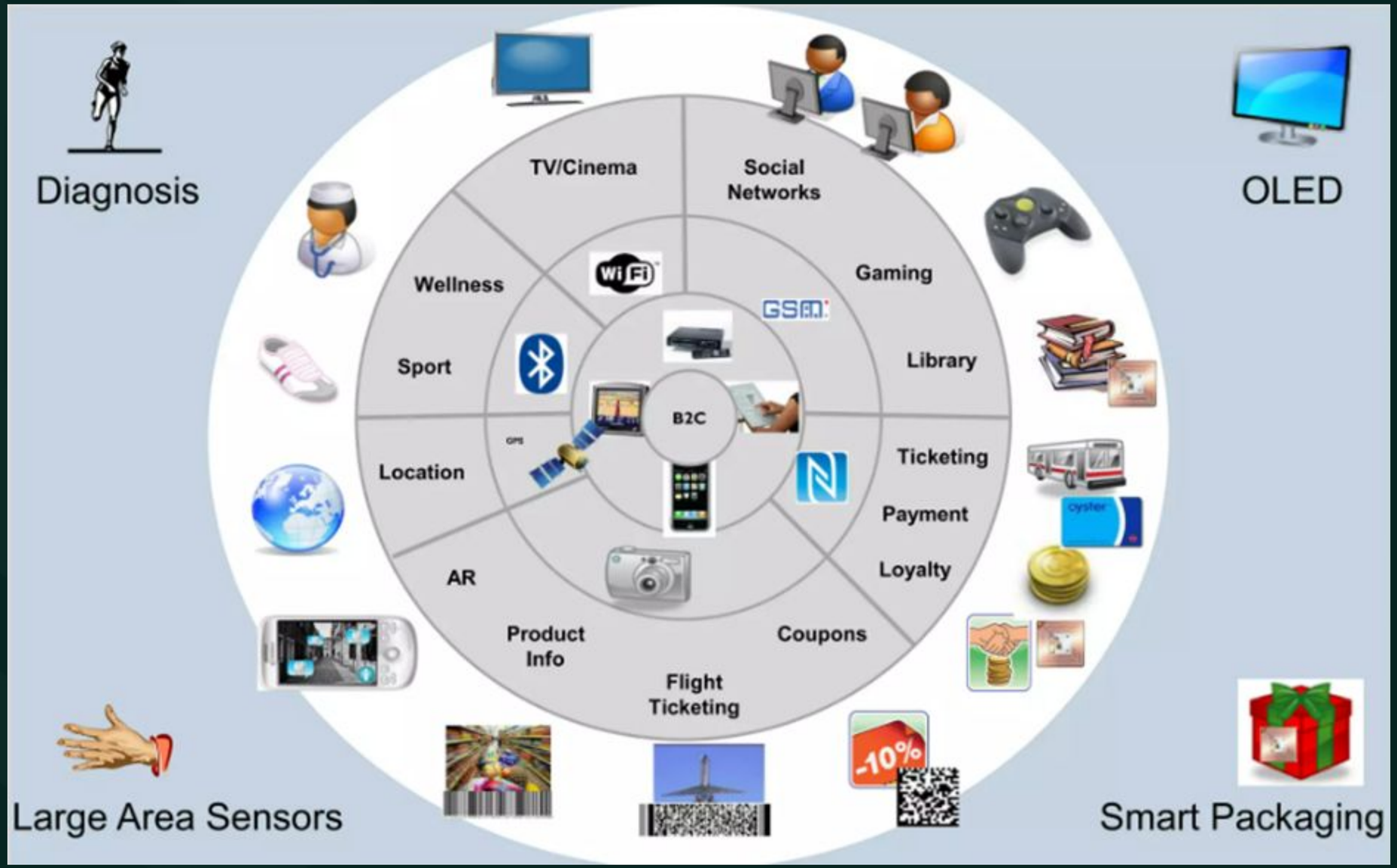


Market Needs



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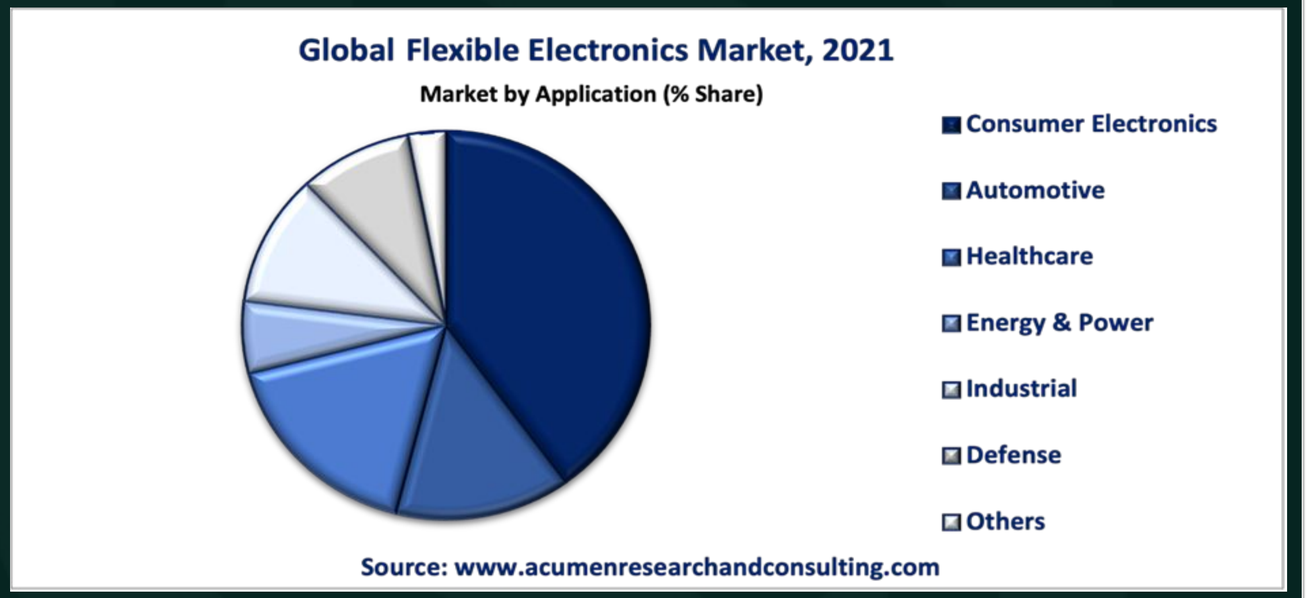

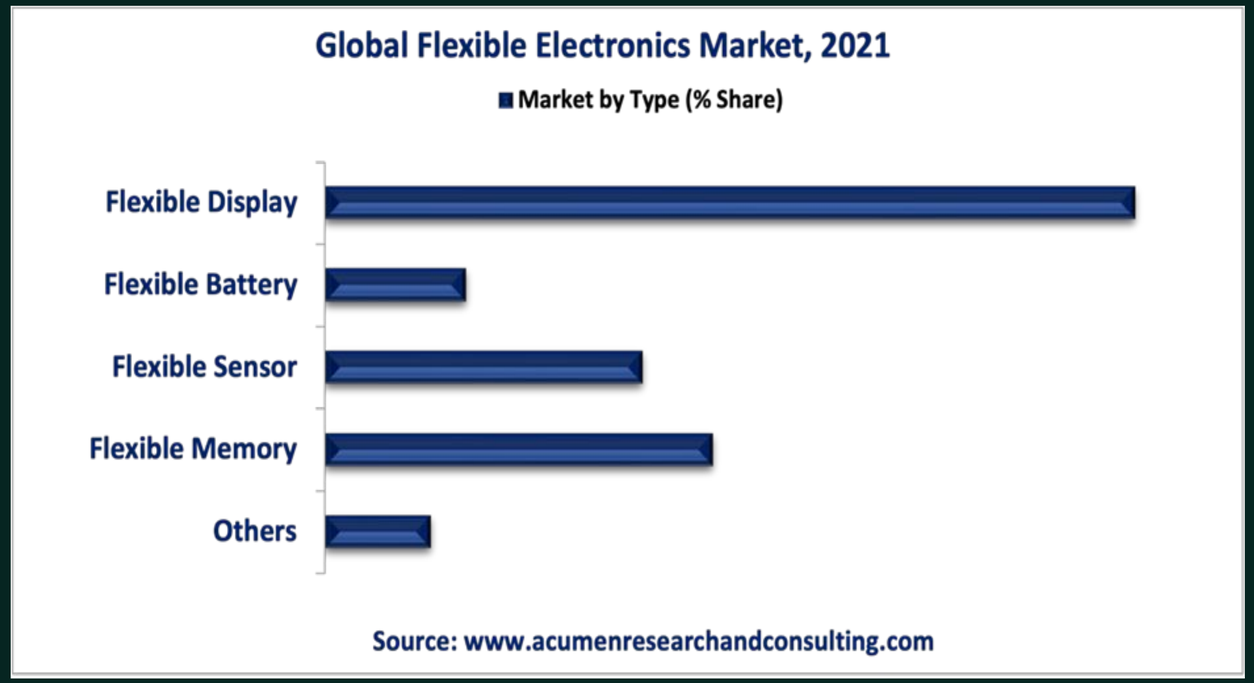

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