

2024 XR Devices and Micro-display Megatrends Analysis

Chief Analyst
Dr. Choonghoon YI

1. Executive Summary	6
2. Analyze Hot Issues	9
2.1 Hot Issues in the XR Industry	
2.2 Hot Issues in the XR Device Industry	
2.3 Micro-display Hot Issues for XR Devices	
2.4 Hot Issues in Optics for XR Devices	
2.5 XR Industries and AI	
3. Digital Convergence Will Be Driven by XR Devices	22
3.1 Digital convergency	
3.2 The First Wave of Digital Convergence	
3.3 The Second Wave of Digital Convergence	
4. XR Definition and Industry Components	28
4.1 What is XR?	
4.2 XR Industry Components	
5. XR Devices Released in 2023 - 1H 2024	32
5.1 XR Devices Released in 2023 - 1H 2024	
5.2 Specification Breakdown of XR Devices Released in 2023 - 1H 2024	
6. Analyzing XR Device Trends Over The Last 5 Years (2019-2023)	46
6.1 Scope and Categorization	
6.2 Analyzing Trends in The Number of XR Device Model Releases	
6.3 Analyzing Optical System Trends for XR Deices	
6.4 Analyzing Display Trends for XR Devices	

6.5 Correlating Optics and Displays for XR Devices	
6.6 Analyzing Tracking Types for XR Devices	
7. AR Device Trends Analysis (2019-2023)	60
7.1 Analyzing Release Trends	
7.2 Analyzing Display Trends	
7.3 Analyzing Optical System Trends	
7.4 Correlating the Display with the Optics	
7.5 Analyzing Power Connection and Tracking Trends	
8. MR Device Trend Analysis (2019-2023)	68
8.1 Analyzing Release Trends	
8.2 Analyzing Display Trends	
8.3 Analyze Optics Trends	
8.4 Correlating Displays and Optics	
8.5 Analyze Power Connection and Tracking Trends	
9. VR Device Trend Analysis (2019-2023)	75
9.1 Analyze Release Trends	
9.2 Analyze Display Trends	
9.3 Analyze Optics Trends	
9.4 Correlating Displays and Optics	
9.5 Analyze Power Connection and Tracking Trends	

10. Analyze Display Trends (2019~2023)	82
10.1 Analyzing Display Ratio	
10.2 Analyze Display Trends by Year	
10.3 Application Ratio Analysis by Micro-display	
10.4 Analyzing Display Ratio by XR Device	
11. Analyze Optics Trends (2019~2023)	88
11.1 Analyze Optics Trends by XR Device	
11.2 Analyzing XR Device Usage by Optics	
11.3 Analyze Optics Trends by Year	
11.4 FoV analysis by XR device	
11.5 Analyzing FoV Trends by Year	
11.6 FoV Analysis by Optics	
12. Analyzing Micro-display and Optis Combinations for XR Devices (2019-2023)	101
12.1 Correlating Micro-display and Optics	
12.2 Correlating the Micro-display with the Optics by XR Device	
12.3 Correlation Analysis with Micro-display and Optics	
12.4 Correlation Analysis with Micro-displays by Optical system	
12.5 Analyzing the Resolution of Micro-displays for AR	
12.6 Analyzing the Resolution of Micro-displays for MR and VR	
12.7 Micro-display and FoV Analysis	

13. Analysis of XR device Makers and Number of Models by Country (2019-2023)	113
13.1 Analysis of The Number of XR Device Makers by Country	
13.2 Analyzing The Number of XR Device Models by Country	
13.3 Analyzing The Number of Companies and Models in Key XR Countries	
14. Micro-OLED	123
14.1 Micro-OLED Structure	
14.2 Micro-OLED Key Players	
14.3 White Micro-OLED Development Trends	
14.4 RGB Micro-OLED Development Trends	
15. Micro-LED	146
15.1 Micro-LED Product Status for XR	
15.2 Micro-LED Development Trends	
16. Optics for AR	163
16.1 Optis Requirements for AR	
16.2 Types of Optics for AR	
16.3 Birdbath Properties	
16.4 Waveguide Type Characteristics	
17. Success Factors for XR Devices and The Micro-display Industry	173
17.1 The Direction of XR Devices Commercialization	
17.2 Success Factors for The MR and AR Device Industry	
17.3 Success Factors for the Micro-display Industry	

2. Analyze Hot Issues

2.3 Micro-display Hot Issues for XR Devices

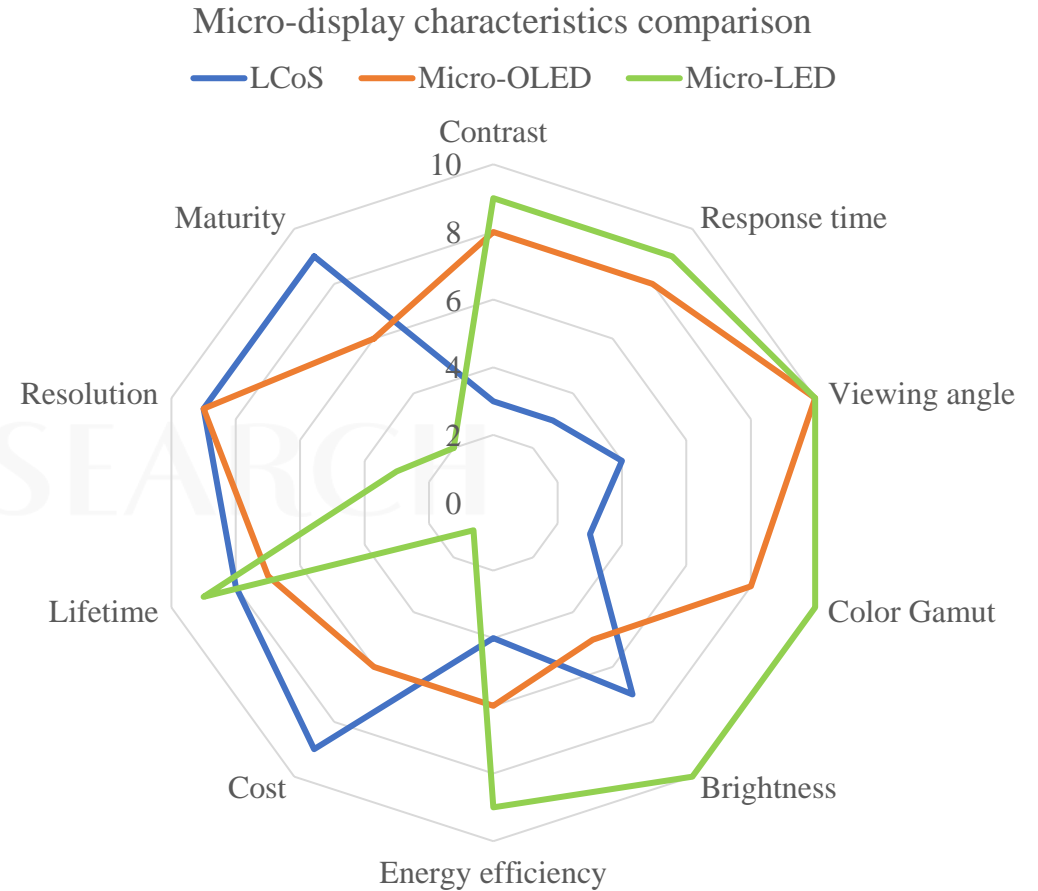
There are three types of micro-displays available for XR devices: LCoS, micro-OLED, and micro-LED.

Unlike displays made on glass substrates, these displays are highly integrated on Si wafers, which allows them to be lightweight.

LCoS, which was first used in XR devices, is competitive with other micro-displays in terms of manufacturing technology, resolution, lifespan, and price. However, because LCoS uses LCDs, it has relatively poor contrast, response time, viewing angle, and color gamut characteristics.

Micro-LEDs, on the other hand, have the opposite characteristics of LCoS. They have excellent contrast ratio, response time, viewing angle, and color gamut. In addition, their brightness, power consumption, and lifespan are superior to other micro-displays. However, micro-LEDs are still very low in manufacturing technology, resulting in very low manufacturing costs and very low resolution.

Micro-OLEDs have features that can compensate for both the advantages and disadvantages of LCoS and micro-LEDs. They have the best viewing angles and resolution, with other characteristics that are also relatively favorable. For this reason, micro-OLEDs are the most popular micro-display for XR devices.



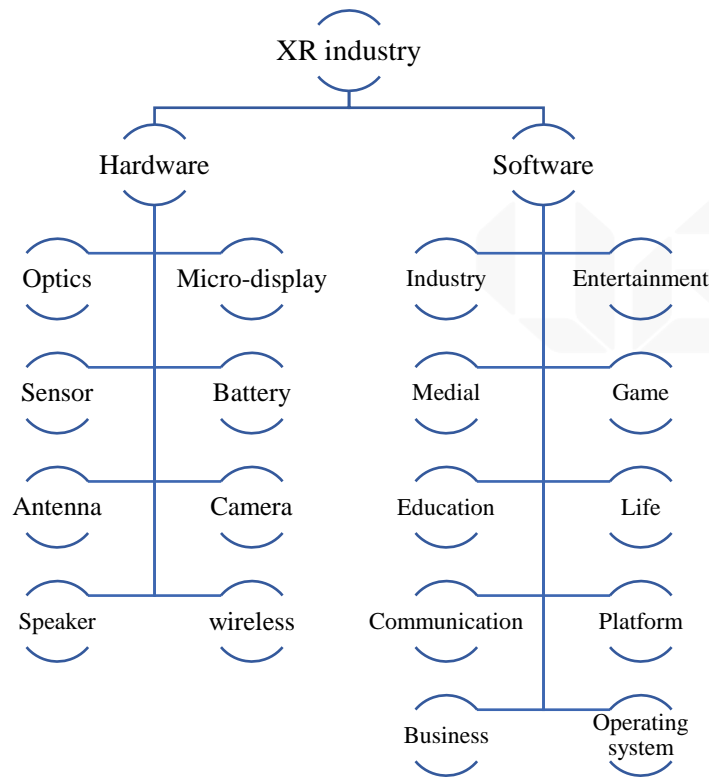
4. XR Definition and Industry Components

4.2 XR Industry Components

The XR industry is composed of the hardware-oriented device industry and the software industry for these devices.

The XR device industry includes AR, VR, and MR device industries, and the component material industry is a key component.

The software industry has many different genres. The table below categorizes the different genres of the XR industry as identified by UBI Research.



Genre Category	Software genre
Industry	SDK, Bootcamp, Remote Assistance ,Modeling, Marketing, Design, Engineering, Architecture
Entertainment	Movie, Film, Music, Streaming, Art, Tour, Video Marking
Medical	Medical, Surgery, Medical examining
Game	Gaming contents, Game Streaming, Game Development
Education	Education
Life	Blockchain & NFT, Tour, Health Management, Map, Motion Tracking, Navigation
Communication	Chatbot, Online Meeting, Social
Platform	Platform, Gaming Platform, Software architecture that acts as a basic structure upon which applications, processes, and technologies are developed and run to enable business or work outcomes
Business	Retail, Advertising
Operating System	Operating System

5. XR Devices Released in 2023 - 1H 2024

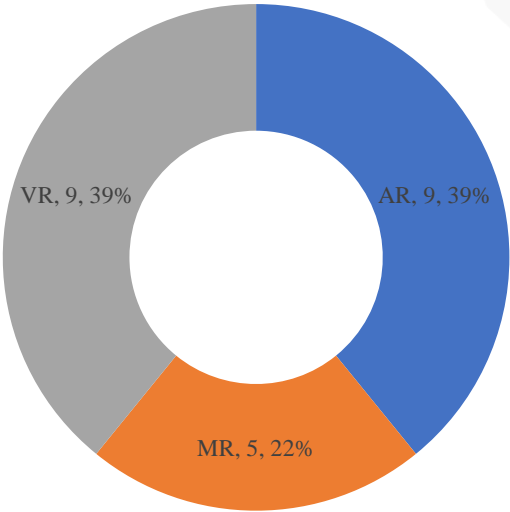
5.2 Specification Breakdown of XR Devices Released in 2023 - 1H 2024

Of the 19 models released in the first half of 2023, AR devices account for 47% with 9 types, VR devices account for 32% with 6 types, and MR devices account for 21% with 4 types.

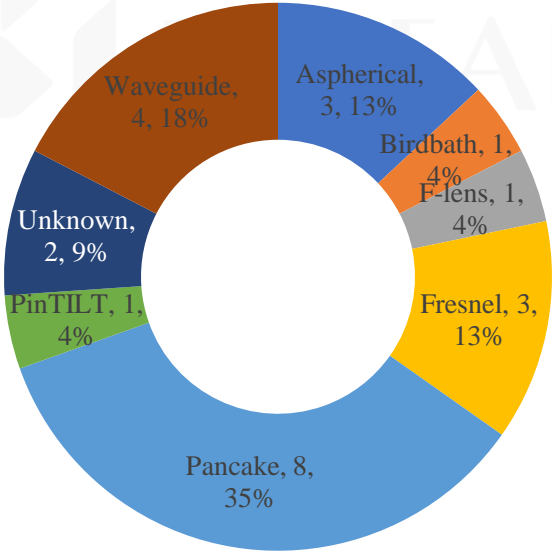
Geometrical optics, such as prisms, account for 63% of the 12 types of optics, and waveguides account for 21% of the 4 types.

There are 5 types of displays for XR, with micro-OLEDs and LCDs comprising 6 types each (32%), LCoS comprising 3 types, and OLEDs and micro-LEDs comprising 1 type each.

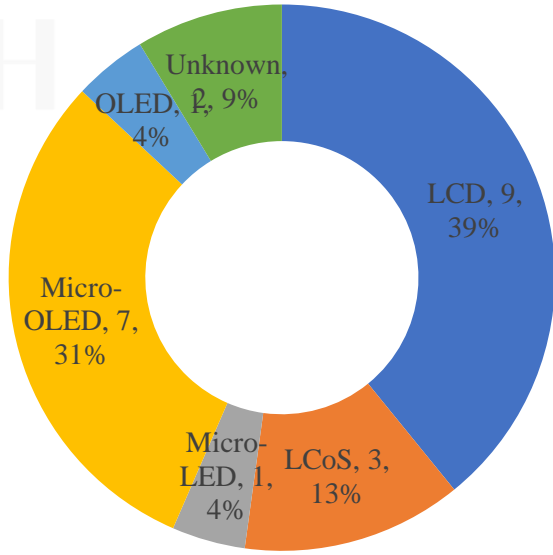
2023~1H24 released XR device model no.



2023~1H24 optics for XR device



2023~1H24 display for XR device



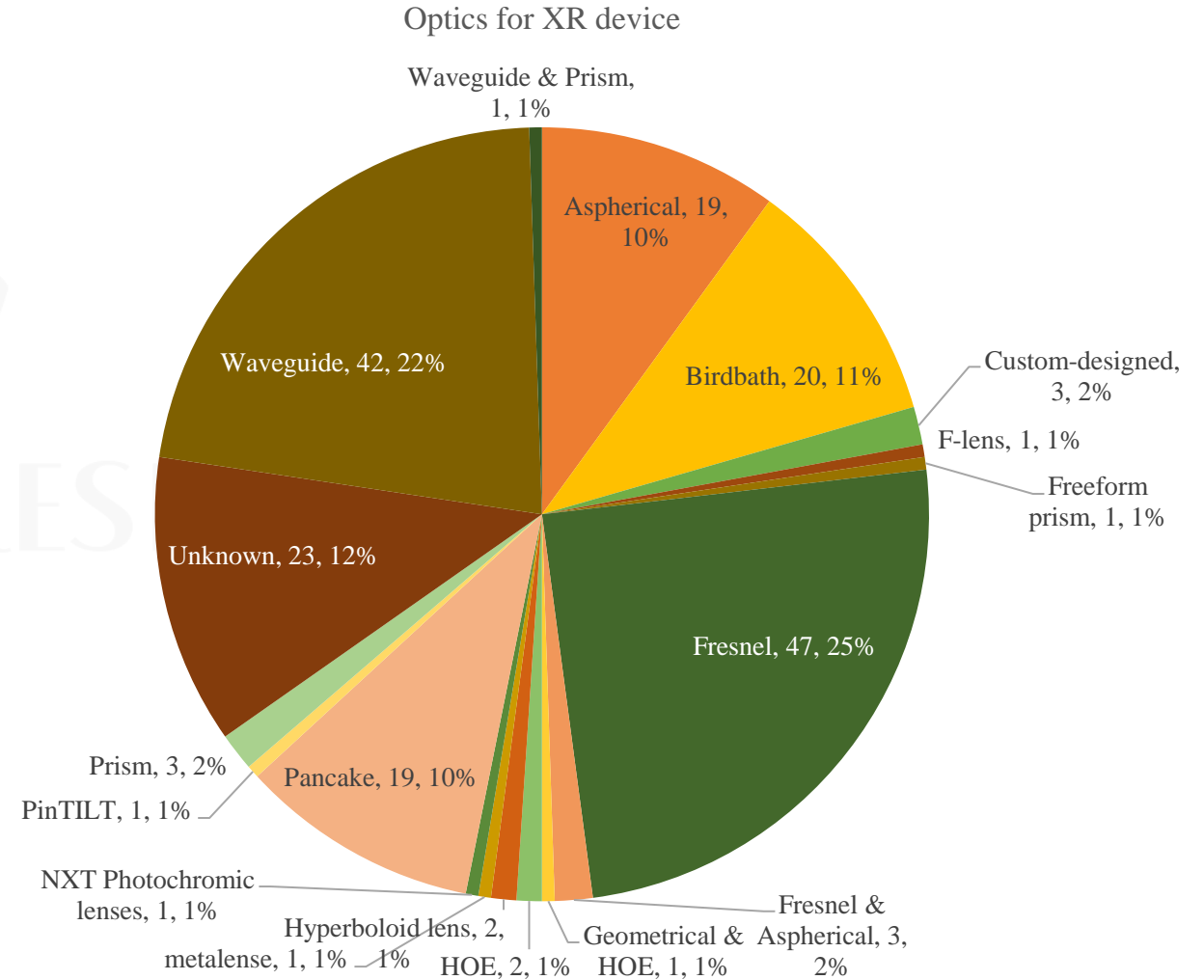
6. Analyzing XR Device Trends Over The Last 5 Years (2019-2023)

6.3 Analyzing Optical System Trends for XR Devices

Of the 190 XR instruments, 18 different optics were used.

The most common is Fresnel, with 47 instruments (25%). This is followed by waveguide with 42 instruments (22%) and birdbath with 20 instruments (11%).

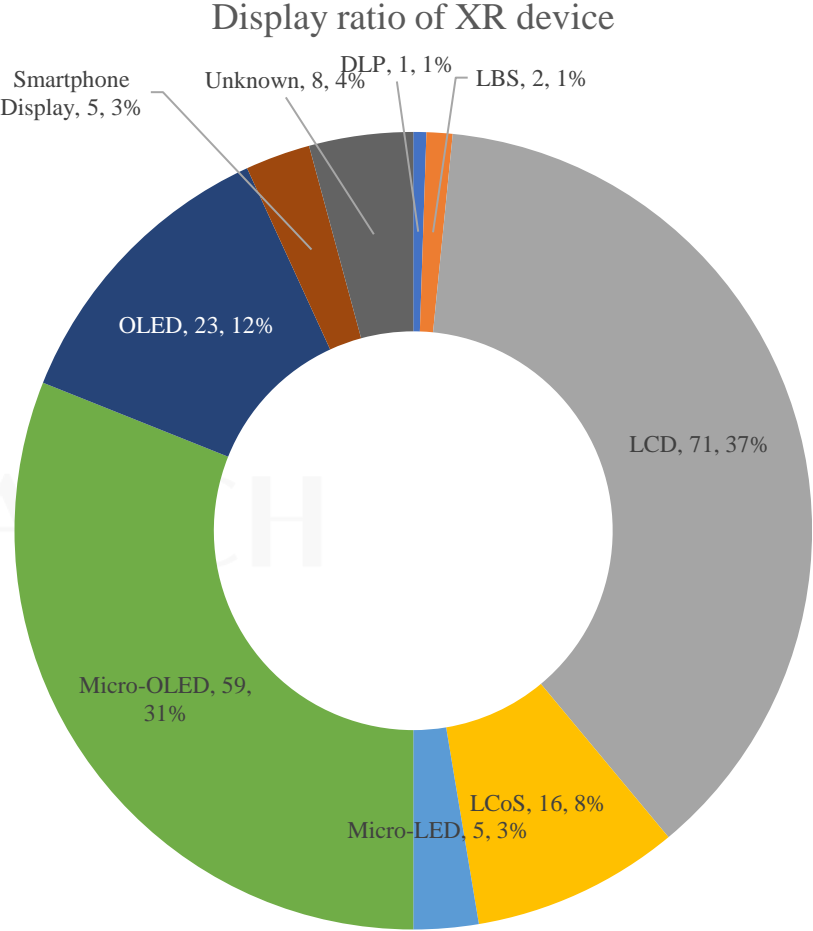
Pancake was used in 19 cases, accounting for 10%.



6. Analyzing XR Device Trends Over The Last 5 Years (2019-2023)

6.4 Analyzing Display Trends for XR Devices

There are 9 display types across the 190 XR devices.
Of these, 71 devices use LCD, accounting for 37%.
The next most common display type is micro-OLED, with 59 types.

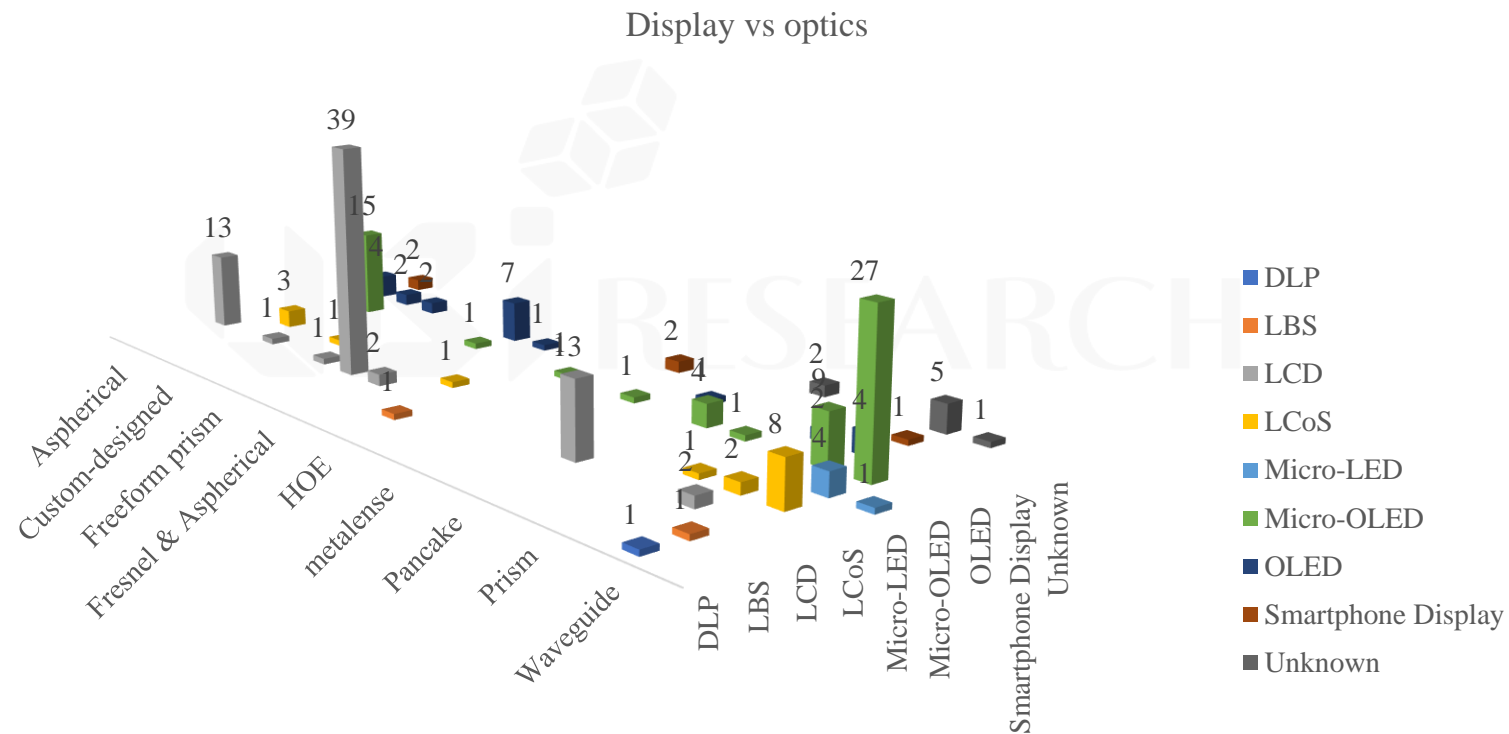


12. Analyzing Micro-display and Optics Combinations for XR Devices (2019-2023)

12.1 Correlating Micro-display and Optics

The most popular display and optics combination in XR devices is LCD and Fresnel, with 39 models.

The next most popular combination is micro-OLED and waveguide, with 29 models, and the third most popular is micro-OLED and birdbath.



@2024 UBI Research

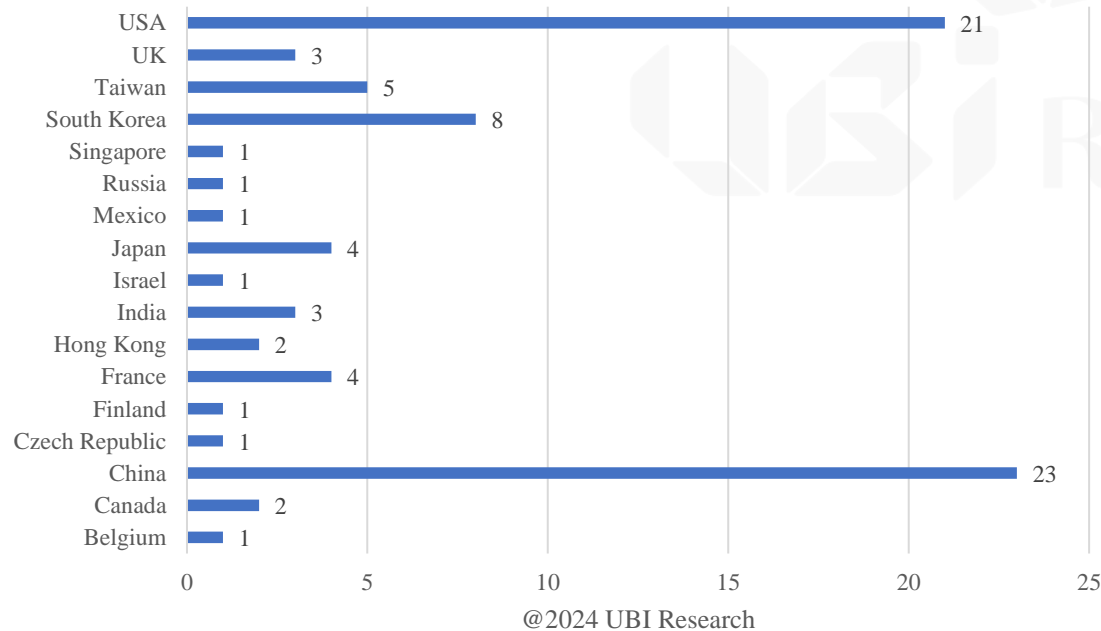
13. Analysis of XR device Makers and Number of Models by Country (2019-2023)

13.1 Analysis of The Number of XR Device Makers by Country

From 2019 through the first half of 2023, 17 countries have released XR devices, with 82 companies.

China is the country with the largest number of companies, followed by the United States and South Korea.

Company no.



Company ratio by nation

