

Silicon Carbide (SiC) Market for Electric Vehicles - A Global and Regional Analysis: Focus on Propulsion Type, Vehicle Type, Application Type, Product Type, Voltage Type, and Country-Level Analysis - Analysis and Forecast, 2023-2032

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Abstracts

Silicon Carbide (SiC) Market for Electric Vehicles (EVs) Overview

The global silicon carbide (SiC) market for electric vehicles is projected to reach \$9,031.2 million by 2032 from \$513.0 million in 2022, growing at a CAGR of 33.02% during the forecast period 2023-2032. The growth in the silicon carbide (SiC) market for electric vehicles (EVs) is expected to be driven by the superior properties of silicon carbide (SiC) material as compared to silicon, growth in the demand for electric vehicles, and increasing investment toward enhancing SiC manufacturing capacity.

Market Lifecycle Stage

The silicon carbide (SiC) market for electric vehicles (EVs) is in a growth phase. The silicon carbide (SiC) market for electric vehicles is experiencing rapid growth and transformation, driven by the compelling advantages that SiC technology offers to the electric mobility sector. SiC, a semiconductor material with superior properties compared to traditional silicon, is revolutionizing the power electronics landscape in EVs. Silicon carbide (SiC) technology's integration into EV power electronics is revolutionizing vehicle performance, enabling faster acceleration, extended range, and efficient energy usage, ultimately enhancing the overall EV driving experience. Silicon carbide (SiC)'s high-frequency capabilities are vital for high-power, fast-charging stations, accelerating the expansion of charging infrastructure and reducing charging times for electric vehicles. Collaborations between electric vehicle manufacturers,

semiconductor companies, and research institutions are driving innovation in SiC technology, resulting in continuous advancements and cost reductions. However, silicon carbide currently comes at a higher cost compared to traditional silicon-based components, impacting its widespread adoption. Scaling up silicon carbide (SiC) production to meet the growing demand from the EV market remains a challenge, requiring further investments in manufacturing capabilities and supply chain optimization. Therefore, addressing cost challenges and expanding manufacturing capabilities is expected to be crucial for companies in realizing silicon carbide (SiC)'s full potential in shaping the electric vehicle landscape.

Impact

The silicon carbide (SiC) market for electric vehicles (EVs) is driven by several factors, such as the benefits of silicon carbide (SiC) material over silicon, growing electric vehicle sales, and growing investment toward encouraging SiC manufacturing capacity by the SiC manufacturers.

Silicon carbide (SiC) manufacturers are partnering with other key stakeholders and investing significantly toward the development of improved silicon carbide (SiC) materials with enhanced properties to mitigate the growing need for advanced power electronics in electric vehicles. With growing efforts by electric vehicle original equipment manufacturers (OEMs) toward improving their electric vehicle offerings, the silicon carbide (SiC) market for electric vehicles (EVs) is expected to grow significantly during the forecast years.

Market Segmentation:

Segmentation 1: by Application

Traction Inverter

On-Board Charger (OBC)

DC-DC Converter

The traction inverter application type segment is poised to assert its dominance in the silicon carbide (SiC) market for electric vehicles. As the automotive landscape pivots toward sustainability and efficiency, the traction inverter segment emerges as a focal

point for innovation. SiC-equipped traction inverters hold the promise of better energy efficiency, extended driving ranges, and optimized battery utilization, addressing pivotal concerns in the EV ecosystem.

Segmentation 2: by Vehicle Type

Passenger Vehicles

Commercial Vehicles

Based on vehicle type, the passenger vehicle segment accounted for a majority stake in the silicon carbide (SiC) market for electric vehicles (EVs) in 2022. Production and sales of passenger electric vehicles are anticipated to be higher than that of commercial vehicles, as more users are rapidly adopting EVs and replacing their IC engine vehicles with EVs due to their cost efficiency and various government subsidies, among others.

Segmentation 3: by Propulsion Type

Battery Electric Vehicles (BEVs)

Hybrid Electric Vehicles (HEVs) and Plug-in Hybrid Electric Vehicles (PHEVs)

Of the two defined propulsion categories, the battery electric vehicles (BEVs) category dominated the silicon carbide (SiC) market for electric vehicles (EVs) in 2022. The advantages of silicon carbide (SiC) power semiconductors over silicon power semiconductors, such as significant reduction in power losses, are driving the usage of materials in BEVs. The developments of EV components with the integration of SiC and the use of such components in advanced new BEV models are expected to support the market growth.

Segmentation 4: by Product

SiC MOSFETs

SiC Diodes

Based on products, the silicon carbide (SiC) market for electric vehicles has been categorized into SiC MOSFETs and SiC diodes. Of the two product categories, the SiC MOSFETs segment dominated the global silicon carbide (SiC) market for electric vehicles (EVs) in 2022. SiC MOSFETs product type is widely used in the silicon carbide (SiC) market for electric vehicles. The unique characteristics of SiC, including high breakdown voltage, low on-resistance, and superior thermal conductivity, translate into MOSFETs that excel in high-power, high-temperature environments. This makes them particularly well-suited for the rigorous demands of EV power electronics.

Segmentation 5: by Voltage

Up to 800V

More than 800V

Based on voltage, the up to 800 V voltage segment offers a well-balanced solution that caters to the requirements of modern electric vehicles. This voltage range enables EV manufacturers to design compact and lightweight power electronics systems, which are essential for enhancing vehicle range and overall performance. Furthermore, the up to 800 V voltage type allows for effective integration of SiC components, resulting in reduced switching losses and increased overall efficiency.

Segmentation 6: by Region

North America

Europe

U.K.

China

Asia-Pacific and Japan (AP&J)

Rest-of-the-World (RoW)

The demand within the silicon carbide (SiC) market for electric vehicles varies according

to various geographical regions. China is expected to dominate the global silicon carbide (SiC) market for electric vehicles as the region has witnessed significant growth in the electric vehicle industry, driven by supportive government policies, increasing environmental concerns, and advancements in technology. China's government support, research investments, and partnerships with silicon carbide (SiC) manufacturers have accelerated the development and implementation of this cutting-edge technology within the electric vehicle ecosystem. Moreover, China's well-established supply chain infrastructure and robust manufacturing capabilities provide a competitive edge in SiC production, contributing to cost reductions and scalability.

Recent Developments in the Silicon Carbide (SiC) Market for Electric Vehicles (EVs)

In June 2023, Infineon Technologies launched 1200 V CoolSiC MOSFETs in TO263-7 for automotive applications. In on-board charging (OBC) and DC-DC applications, the automotive-grade silicon carbide (SiC) MOSFET generation delivers great power density and efficiency, permits bi-directional charging, and dramatically lowers system cost.

In April 2023, Wolfspeed, Inc. announced that it would provide silicon carbide devices to power future Mercedes-Benz electric vehicle (EV) platforms, enabling higher powertrain efficiency. The next-generation powertrain systems for numerous Mercedes-Benz vehicle lines would include semiconductors from Wolfspeed, Inc.

In March 2023, Mitsubishi Electric announced that it would be investing \$1.87 billion in the coming five years to boost the production capacity of silicon carbide (SiC) power semiconductors. The investment would be used to construct a new wafer plant.

In February 2023, Microchip Technology Inc. announced that it would be investing \$880 million in the upcoming years in order to increase its SiC and silicon production capacity.

In January 2023, Wolfspeed, Inc. and ZF established a strategic alliance to enhance silicon carbide systems and devices for mobility, industry, and energy applications. This agreement would entail the establishment of a collaborative innovation lab. The cooperation also includes a sizable investment by ZF to enable the development of the largest and most sophisticated 200mm silicon carbide device fab in the world in Ensdorf, Germany.

In August 2022, Onsemi inaugurated its new silicon carbide (SiC) production facility in New Hampshire, U.S. The new facility would increase the company's SiC production capacity, which would help in catering to the growing demand.

Demand - Drivers and Limitations

The following are the demand drivers for the silicon carbide (SiC) market for electric vehicles (EVs):

Superior Properties of Silicon Carbide Compared to Silicon

Growth in the Demand for Electric Vehicles

Increasing Investment toward Enhancing SiC Manufacturing Capacity

The following are the challenges for the silicon carbide (SiC) market for electric vehicles (EVs):

Higher Manufacturing Cost Associated with SiC Semiconductors

Limitation of Producing Large-Diameter SiC Wafers

How can this report add value to an organization?

Product/Innovation Strategy: Globally, the leading and emerging silicon carbide (SiC) manufacturers are continuously working to make their SiC offerings more power-efficient than ever. High SiC device cost and low yield are among some of the major concerns among the silicon carbide (SiC) manufacturers in the silicon carbide (SiC) industry for electric vehicles (EVs). The players operating in the silicon carbide (SiC) market for electric vehicles (EVs) have been working on the development of improved silicon carbide (SiC) to mitigate the growing challenges associated with yield numbers and device costs.

Growth/Marketing Strategy: The silicon carbide (SiC) market for electric vehicles (EVs) has been growing at a rapid pace. The market offers enormous opportunities for

existing and emerging market players. Some of the strategies covered in this segment are product launches, partnerships, collaborations, business expansions, and investments. The strategies preferred by companies to maintain and strengthen their market position primarily include market developments and partnerships, collaborations, acquisitions, and joint ventures.

Competitive Strategy: The key players in the silicon carbide (SiC) market for electric vehicles (EVs) analyzed and profiled in the study include silicon carbide (SiC) manufacturers that design, develop and market silicon carbide (SiC) materials for electric vehicles (EVs). Moreover, a detailed competitive benchmarking of the players operating in the silicon carbide (SiC) market for electric vehicles (EVs) has been done to help the reader understand the ways in which players stack against each other, presenting a clear market landscape. Additionally, comprehensive competitive strategies such as partnerships, agreements, and collaborations will aid the reader in understanding the untapped revenue pockets in the market.

Key Market Players and Competition Synopsis

The companies that are profiled have been selected based on inputs gathered from primary experts and analyzing company coverage, product portfolio, and market penetration.

The global silicon carbide (SiC) market for electric vehicles (EVs) is highly consolidated, where the top two manufacturers alone accounted for around 70% of the market share in 2022, while the remaining companies operating in the market captured around 30% of the market share.

Key Companies Profiled:

Wolfspeed, Inc.

Infineon Technologies

Onsemi

Coherent Corp. (previously known as II-VI Incorporated)

STMicroelectronics

Robert Bosch GmbH

ROHM CO., LTD.

Microchip Technology Inc.

Mitsubishi Electric

Alpha and Omega Semiconductor

Toshiba Corporation

Littelfuse, Inc

GeneSiC Semiconductor

Fuji Electric Co. Ltd.

WeEn Semiconductors

Solitron Devices, Inc.

Companies that are not a part of the aforementioned pool have been well represented across different sections of the report (wherever applicable).

Contents

1 MARKETS

1.1 Industry Outlook

1.1.1 Market Definition

1.1.2 Market Trends

1.1.2.1 Future Communication Technologies for Smart Farming

1.1.2.1.1 5G: The Future of Smart Farming

1.1.2.1.2 LoRa Wide Area Network (LoRaWAN)

1.1.3 Ecosystem/Ongoing Programs

1.1.3.1 Consortiums and Associations

1.1.3.2 Regulatory Bodies

1.1.3.3 Government Programs

1.2 Business Dynamics

1.2.1 Business Drivers

1.2.1.1 Need for Automation of Work Force in Agriculture

1.2.1.2 Rising Concerns over Agriculture Sustainability

1.2.1.2.1 Increase in Land Degradation

1.2.1.2.2 Agriculture Sector Emissions

1.2.1.3 Need For Technology in Livestock Monitoring and Disease Detection

1.2.1.4 Increasing Demand for Global Food Security owing to Population Growth and

Urbanization

1.2.2 Business Challenges

1.2.2.1 Lack of Compatible Infrastructure

1.2.2.2 Large Capital Investments

1.2.2.3 Rising Concern over Data Security with Increasing Cyber Attacks

1.2.2.4 Lack of Interoperability Hindering the Growth

1.2.3 Business Strategies

1.2.3.1 Product Development and Innovation

1.2.3.2 Market Development

1.2.4 Corporate Strategies

1.2.4.1 Mergers and Acquisitions

1.2.4.2 Partnerships, Joint Ventures, Collaborations, and Alliances

1.2.4.3 Agreement and Others

1.2.4.4 Snapshot of Corporate Strategies Adopted by the Players in Global Smart

Farming Market

1.2.5 Business Opportunities

1.2.5.1 Integration of Emerging Technologies with Existing Practices

1.2.5.2 Securing the Agriculture Value Chain with Blockchain

1.3 Case Studies

1.3.1 Smart Farming Case Studies

1.4 Start-Up Landscape

1.4.1 Key Start-Ups in the Ecosystem

1.4.2 Funding Analysis

1.4.2.1 Total Investments and Number of Funding Deals

1.4.2.2 Top Funding Deals, 2021

1.4.2.3 Funding (by Technology)

1.4.2.4 Funding (by Year)

2 APPLICATION

2.1 Global Smart Farming Market (by Application)

2.1.1 Precision Farming or Precision Agriculture

2.1.1.1 Precision Irrigation

2.1.1.2 Yield Monitoring and Crop Scouting or Forecasting

2.1.1.3 Precision Planting

2.1.1.4 Precision Spraying

2.1.1.5 Precision Fertilization

2.1.1.6 Farm Management

2.1.1.7 Other

2.1.2 Livestock Monitoring and Management

2.1.2.1 Milk Harvesting

2.1.2.2 Animal Health Monitoring and Comfort

2.1.2.3 Feeding Management

2.1.2.4 Livestock Tracking

2.1.2.5 Other

2.1.3 Aquaculture

2.1.3.1 Feed Management

2.1.3.2 Aquatic Species Tracking and Navigation

2.1.3.3 Water Quality Management

2.1.3.4 Other

2.1.4 Other Applications

2.2 Demand Analysis Global Smart Farming Market (by Application)

3 PRODUCTS

3.1 Global Smart Farming Market (by Product)

- 3.1.1 Hardware
 - 3.1.1.1 Displays/Yield Monitors
 - 3.1.1.2 Flow and Application Rate Control Valves
 - 3.1.1.3 Farm Computers and Mobile Devices & Laptops
 - 3.1.1.4 Agricultural Sensors
 - 3.1.1.5 Guidance and Steering Systems
 - 3.1.1.6 Others
- 3.1.2 Software
 - 3.1.2.1 Software Type
 - 3.1.2.1.1 Farm Operation Management
 - 3.1.2.1.2 Hardware Control Application
 - 3.1.2.1.3 Data and Predictive Analytics
- 3.2 Demand Analysis Global Smart Farming Market (by Product)
- 3.3 Patent Analysis
 - 3.3.1 Patent Analysis (by Objective)
 - 3.3.1.1 Patent Analysis (by Application)
 - 3.3.2 Patent Analysis (by Organization)
 - 3.3.3 Patent Analysis (by Patent Office)
- 3.4 Adoption Analysis
 - 3.4.1 Trends in Agriculture Industry
 - 3.4.2 Adoption Scenarios
- 3.5 Technology Roadmap
 - 3.5.1 Timeline of Agricultural Evolution
- 3.6 Value Chain Analysis

4 REGION

- 4.1 North America
 - 4.1.1 Market
 - 4.1.1.1 Key Companies in North America
 - 4.1.1.2 Business Drivers
 - 4.1.1.3 Business Challenges
 - 4.1.2 Application
 - 4.1.2.1 North America Smart Farming Market (by Application)
 - 4.1.3 Product
 - 4.1.3.1 North America Smart Farming Market (by Product)
 - 4.1.4 North America Smart Farming Market (by Country)
 - 4.1.4.1 U.S.
 - 4.1.4.1.1 Market

- 4.1.4.1.1.1 Buyer Attributes
- 4.1.4.1.1.2 Business Challenges
- 4.1.4.1.1.3 Business Drivers
- 4.1.4.1.2 Application
 - 4.1.4.1.2.1 U.S. Smart Farming Market (by Application), \$Million, 2021-2027
- 4.1.4.1.3 Product
 - 4.1.4.1.3.1 U.S. Smart Farming Market (by Product), \$Million, 2021-2027
- 4.1.4.2 Canada
 - 4.1.4.2.1 Market
 - 4.1.4.2.1.1 Buyer Attributes
 - 4.1.4.2.1.2 Business Challenges
 - 4.1.4.2.1.3 Business Drivers
 - 4.1.4.2.2 Application
 - 4.1.4.2.2.1 Canada Smart Farming Market (by Application), \$Million, 2021-2027
 - 4.1.4.2.3 Product
 - 4.1.4.2.3.1 Canada Smart Farming Market (by Product), \$Million, 2021-2027
- 4.1.4.3 Mexico
 - 4.1.4.3.1 Market
 - 4.1.4.3.1.1 Buyer Attributes
 - 4.1.4.3.1.2 Business Challenges
 - 4.1.4.3.1.3 Business Drivers
 - 4.1.4.3.2 Application
 - 4.1.4.3.2.1 Mexico Smart Farming Market (by Application), \$Million, 2021-2027
 - 4.1.4.3.3 Product
 - 4.1.4.3.3.1 Mexico Smart Farming Market (by Product), \$Million, 2021-2027
- 4.2 Europe
 - 4.2.1 Market
 - 4.2.1.1 Buyer Attributes
 - 4.2.1.2 Key Companies in Europe
 - 4.2.1.3 Business Drivers
 - 4.2.1.4 Business Challenges
 - 4.2.2 Application
 - 4.2.2.1 Europe Smart Farming Market (by Application)
 - 4.2.3 Product
 - 4.2.3.1 Europe Smart Farming Market (by Product)
 - 4.2.4 Europe Smart Farming Market (by Country)
 - 4.2.4.1 Germany
 - 4.2.4.1.1 Market
 - 4.2.4.1.1.1 Buyer Attributes

- 4.2.4.1.1.2 Business Challenges
- 4.2.4.1.1.3 Business Drivers
- 4.2.4.1.2 Application
 - 4.2.4.1.2.1 Germany Smart Farming Market (by Application), \$Million, 2021-2027
- 4.2.4.1.3 Product
 - 4.2.4.1.3.1 Germany Smart Farming Market (by Product), \$Million, 2021-2027
- 4.2.4.2 France
 - 4.2.4.2.1 Market
 - 4.2.4.2.1.1 Buyer Attributes
 - 4.2.4.2.1.2 Business Challenges
 - 4.2.4.2.1.3 Business Drivers
 - 4.2.4.2.2 Application
 - 4.2.4.2.2.1 France Smart Farming Market (by Application), \$Million, 2021-2027
 - 4.2.4.2.3 Product
 - 4.2.4.2.3.1 France Smart Farming Market (by Product), \$Million, 2021-2027
- 4.2.4.3 Netherlands
 - 4.2.4.3.1 Market
 - 4.2.4.3.1.1 Buyer Attributes
 - 4.2.4.3.1.2 Business Challenges
 - 4.2.4.3.1.3 Business Drivers
 - 4.2.4.3.2 Application
 - 4.2.4.3.2.1 Netherlands Smart Farming Market (by Application), \$Million, 2021-2027
 - 4.2.4.3.3 Product
 - 4.2.4.3.3.1 Netherlands Smart Farming Market (by Product), \$Million, 2021-2027
- 4.2.4.4 Italy
 - 4.2.4.4.1 Market
 - 4.2.4.4.1.1 Buyer Attributes
 - 4.2.4.4.1.2 Business Challenges
 - 4.2.4.4.1.3 Business Drivers
 - 4.2.4.4.2 Application
 - 4.2.4.4.2.1 Italy Smart Farming Market (by Application), \$Million, 2021-2027
 - 4.2.4.4.3 Product
 - 4.2.4.4.3.1 Italy Smart Farming Market (by Product), \$Million, 2021-2027
- 4.2.4.5 Spain
 - 4.2.4.5.1 Market
 - 4.2.4.5.1.1 Buyer Attributes
 - 4.2.4.5.1.2 Business Challenges
 - 4.2.4.5.1.3 Business Drivers
 - 4.2.4.5.2 Application

- 4.2.4.5.2.1 Spain Smart Farming Market (by Application), \$Million, 2021-2027
- 4.2.4.5.3 Product
 - 4.2.4.5.3.1 Spain Smart Farming Market (by Product), \$Million, 2021-2027
- 4.2.4.6 Greece
 - 4.2.4.6.1 Market
 - 4.2.4.6.1.1 Buyer Attributes
 - 4.2.4.6.1.2 Business Challenges
 - 4.2.4.6.1.3 Business Drivers
 - 4.2.4.6.2 Application
 - 4.2.4.6.2.1 Greece Smart Farming Market (by Application), \$Million, 2021-2027
 - 4.2.4.6.3 Product
 - 4.2.4.6.3.1 Greece Smart Farming Market (by Product), \$Million, 2021-2027
- 4.2.4.7 Switzerland
 - 4.2.4.7.1 Market
 - 4.2.4.7.1.1 Buyer Attributes
 - 4.2.4.7.1.2 Business Challenges
 - 4.2.4.7.1.3 Business Drivers
 - 4.2.4.7.2 Application
 - 4.2.4.7.2.1 Switzerland Smart Farming Market (by Application), \$Million, 2021-2027
 - 4.2.4.7.3 Product
 - 4.2.4.7.3.1 Switzerland Smart Farming Market (by Product), \$Million, 2021-2027
- 4.2.4.8 Ukraine
 - 4.2.4.8.1 Market
 - 4.2.4.8.1.1 Buyer Attributes
 - 4.2.4.8.1.2 Business Challenges
 - 4.2.4.8.1.3 Business Drivers
 - 4.2.4.8.2 Application
 - 4.2.4.8.2.1 Ukraine Smart Farming Market (by Application), \$Million, 2021-2027
 - 4.2.4.8.3 Product
 - 4.2.4.8.3.1 Ukraine Smart Farming Market (by Product), \$Million, 2021-2027
- 4.2.4.9 Belgium
 - 4.2.4.9.1 Market
 - 4.2.4.9.1.1 Buyer Attributes
 - 4.2.4.9.1.2 Business Challenges
 - 4.2.4.9.1.3 Business Drivers
 - 4.2.4.9.2 Application
 - 4.2.4.9.2.1 Belgium Smart Farming Market (by Application), \$Million, 2021-2027
 - 4.2.4.9.3 Product
 - 4.2.4.9.3.1 Belgium Smart Farming Market (by Product), \$Million, 2021-2027

- 4.2.4.10 Rest-of-Europe
 - 4.2.4.10.1 Market
 - 4.2.4.10.1.1 Buyer Attributes
 - 4.2.4.10.1.2 Business Challenges
 - 4.2.4.10.1.3 Business Drivers
 - 4.2.4.10.2 Application
 - 4.2.4.10.2.1 Rest-of-Europe Smart Farming Market (by Application), \$Million, 2021-2027
 - 4.2.4.10.3 Product
 - 4.2.4.10.3.1 Rest-of-Europe Smart Farming Market (by Product), \$Million, 2021-2027
- 4.3 U.K.
 - 4.3.1 Market
 - 4.3.1.1 Buyer Attributes
 - 4.3.1.2 Key Companies in the U.K.
 - 4.3.1.3 Business Drivers
 - 4.3.1.4 Business Challenges
 - 4.3.2 Application
 - 4.3.2.1 U.K. Smart Farming Market (by Application)
 - 4.3.3 Product
 - 4.3.3.1 U.K. Smart Farming Market (by Product)
- 4.4 China
 - 4.4.1 Market
 - 4.4.1.1 Buyer Attributes
 - 4.4.1.2 Key Companies in China
 - 4.4.1.3 Business Drivers
 - 4.4.1.4 Business Challenges
 - 4.4.2 Application
 - 4.4.2.1 China Smart Farming Market (by Application)
 - 4.4.3 Product
 - 4.4.3.1 China Smart Farming Market (by Product)
- 4.5 Asia-Pacific
 - 4.5.1 Market
 - 4.5.1.1 Key Companies in Asia-Pacific
 - 4.5.1.2 Buyer Attributes
 - 4.5.1.3 Business Drivers
 - 4.5.1.4 Business Challenges
 - 4.5.2 Application
 - 4.5.2.1 Asia-Pacific Smart Farming Market (by Application)
 - 4.5.3 Product

4.5.3.1 Asia-Pacific Smart Farming Market (by Product)

4.5.4 Asia-Pacific Smart Farming Market (by Country)

4.5.4.1 Japan

4.5.4.1.1 Market

4.5.4.1.1.1 Buyer Attributes

4.5.4.1.1.2 Business Challenges

4.5.4.1.1.3 Business Drivers

4.5.4.1.2 Application

4.5.4.1.2.1 Japan Smart Farming Market (by Application), \$Million, 2021-2027

4.5.4.1.3 Product

4.5.4.1.3.1 Japan Smart Farming Market (by Product), \$Million, 2021-2027

4.5.4.2 India

4.5.4.2.1 Market

4.5.4.2.1.1 Buyer Attributes

4.5.4.2.1.2 Business Challenges

4.5.4.2.1.3 Business Drivers

4.5.4.2.2 Application

4.5.4.2.2.1 India Smart Farming Market (by Application), \$Million, 2021-2027

4.5.4.2.3 Product

4.5.4.2.3.1 India Smart Farming Market (by Product), \$Million, 2021-2027

4.5.4.3 Australia and New Zealand

4.5.4.3.1 Market

4.5.4.3.1.1 Buyer Attributes

4.5.4.3.1.2 Business Challenges

4.5.4.3.1.3 Business Drivers

4.5.4.3.2 Application

4.5.4.3.2.1 Australia and New Zealand Smart Farming Market (by Application), \$Million, 2021-2027

4.5.4.3.3 Product

4.5.4.3.3.1 Australia and New Zealand Smart Farming Market (by Product), \$Million, 2021-2027

4.5.4.4 Thailand

4.5.4.4.1 Market

4.5.4.4.1.1 Buyer Attributes

4.5.4.4.1.2 Business Challenges

4.5.4.4.1.3 Business Drivers

4.5.4.4.2 Application

4.5.4.4.2.1 Thailand Smart Farming Market (by Application), \$Million, 2021-2027

4.5.4.4.3 Product

- 4.5.4.4.3.1 Thailand Smart Farming Market (by Product), \$Million, 2021-2027
- 4.5.4.5 South Korea
 - 4.5.4.5.1 Market
 - 4.5.4.5.1.1 Buyer Attributes
 - 4.5.4.5.1.2 Business Challenges
 - 4.5.4.5.1.3 Business Drivers
 - 4.5.4.5.2 Application
 - 4.5.4.5.2.1 South Korea Smart Farming Market (by Application), \$Million, 2021-2027
 - 4.5.4.5.3 Product
 - 4.5.4.5.3.1 South Korea Smart Farming Market (by Product), \$Million, 2021-2027
- 4.5.4.6 Rest-of-Asia-Pacific
 - 4.5.4.6.1 Market
 - 4.5.4.6.1.1 Buyer Attributes
 - 4.5.4.6.1.2 Business Challenges
 - 4.5.4.6.1.3 Business Drivers
 - 4.5.4.6.2 Application
 - 4.5.4.6.2.1 Rest-of-Asia-Pacific Smart Farming Market (by Application), \$Million, 2021-2027
 - 4.5.4.6.3 Product
 - 4.5.4.6.3.1 Rest-of-Asia-Pacific Smart Farming Market (by Product), \$Million, 2021-2027
- 4.6 Middle East and Africa
 - 4.6.1 Market
 - 4.6.1.1 Buyer Attributes
 - 4.6.1.2 Key Providers in the Middle East and Africa
 - 4.6.1.3 Business Challenges
 - 4.6.1.4 Business Drivers
 - 4.6.2 Application
 - 4.6.2.1 Middle East and Africa Smart Farming Market (by Application), \$Million, 2021-2027
 - 4.6.3 Product
 - 4.6.3.1 Middle East and Africa Smart Farming Market (by Product), \$Million, 2021-2027
 - 4.6.4 Middle East and Africa (by Country)
 - 4.6.4.1 Israel
 - 4.6.4.1.1 Market
 - 4.6.4.1.1.1 Buyer Attributes
 - 4.6.4.1.1.2 Business Challenges
 - 4.6.4.1.1.3 Business Drivers

- 4.6.4.1.2 Application
 - 4.6.4.1.2.1 Israel Smart Farming Market (by Application), \$Million, 2021-2027
- 4.6.4.1.3 Product
 - 4.6.4.1.3.1 Israel Smart Farming Market (by Product), \$Million, 2021-2027
- 4.6.4.2 South Africa
 - 4.6.4.2.1 Market
 - 4.6.4.2.1.1 Buyer Attributes
 - 4.6.4.2.1.2 Business Challenges
 - 4.6.4.2.1.3 Business Drivers
 - 4.6.4.2.2 Application
 - 4.6.4.2.2.1 South Africa Smart Farming Market (by Application), \$Million, 2021-2027
 - 4.6.4.2.3 Product
 - 4.6.4.2.3.1 South Africa Smart Farming Market (by Product), \$Million, 2021-2027
- 4.6.4.3 Turkey
 - 4.6.4.3.1 Market
 - 4.6.4.3.1.1 Buyer Attributes
 - 4.6.4.3.1.2 Business Challenges
 - 4.6.4.3.1.3 Business Drivers
 - 4.6.4.3.2 Application
 - 4.6.4.3.2.1 Turkey Smart Farming Market (by Application), \$Million, 2021-2027
 - 4.6.4.3.3 Product
 - 4.6.4.3.3.1 Turkey Smart Farming Market (by Product), \$Million, 2021-2027
- 4.6.4.4 Rest-of-Middle East and Africa
 - 4.6.4.4.1 Market
 - 4.6.4.4.1.1 Buyer Attributes
 - 4.6.4.4.1.2 Business Challenges
 - 4.6.4.4.1.3 Business Drivers
 - 4.6.4.4.2 Application
 - 4.6.4.4.2.1 Rest-of-Middle East and Africa Smart Farming Market (by Application), \$Million, 2021-2027
 - 4.6.4.4.3 Product
 - 4.6.4.4.3.1 Rest-of-Middle East and Africa Smart Farming Market (by Product), \$Million, 2021-2027
- 4.7 South America
 - 4.7.1 Market
 - 4.7.1.1 Buyer Attributes
 - 4.7.1.2 Key Providers in South America
 - 4.7.1.3 Business Challenges
 - 4.7.1.4 Business Drivers

4.7.2 Application

4.7.2.1 South America Smart Farming Market (by Application), \$Million, 2021-2027

4.7.3 Product

4.7.3.1 South America Smart Farming Market (by Product), \$Million, 2021-2027

4.7.4 South America (by Country)

4.7.4.1 Brazil

4.7.4.1.1 Market

4.7.4.1.1.1 Buyer Attributes

4.7.4.1.1.2 Business Challenges

4.7.4.1.1.3 Business Drivers

4.7.4.1.2 Application

4.7.4.1.2.1 Brazil Smart Farming Market (by Application), \$Million, 2021-2027

4.7.4.1.3 Product

4.7.4.1.3.1 Brazil Smart Farming Market (by Product), \$Million, 2021-2027

4.7.4.2 Rest-of-South America

4.7.4.2.1 Market

4.7.4.2.1.1 Buyer Attributes

4.7.4.2.1.2 Business Challenges

4.7.4.2.1.3 Business Drivers

4.7.4.2.2 Application

4.7.4.2.2.1 Rest-of-South America Smart Farming Market (by Application), \$Million, 2021-2027

4.7.4.2.3 Product

4.7.4.2.3.1 Rest-of-South America Smart Farming Market (by Product), \$Million, 2021-2027

5 MARKETS - COMPETITIVE BENCHMARKING AND COMPANY PROFILES

5.1 Competitive Benchmarking

5.1.1 Precision Farming Companies

5.1.2 Livestock Monitoring and Management Companies

5.2 Market Share Analysis

5.2.1 Market Share Analysis of Precision Farming Equipment Manufacturers

5.2.2 Market Share Analysis of Livestock Monitoring & Management Solutions

Providers

5.3 Company Profiles

5.3.1 Precision Farming and Farm Management

5.3.1.1 Ag Leader Technology

5.3.1.1.1 Company Overview

- 5.3.1.1.2 Role of Ag Leader Technology in the Smart Farming Market
- 5.3.1.1.3 Pricing and Product Portfolio
 - 5.3.1.1.3.1 Target Customers
 - 5.3.1.1.4 Business Strategies
 - 5.3.1.1.4.1 Product Developments
 - 5.3.1.1.5 Analyst View
- 5.3.1.2 AGCO Corporation
 - 5.3.1.2.1 Company Overview
 - 5.3.1.2.2 Role of AGCO Corporation in the Smart Farming Market
 - 5.3.1.2.3 Product Portfolio
 - 5.3.1.2.3.1 Target Customers
 - 5.3.1.2.3.2 Key Clients/Customers
 - 5.3.1.2.4 Business Strategies
 - 5.3.1.2.4.1 Product Developments
 - 5.3.1.2.4.2 Market Development
 - 5.3.1.2.5 Corporate Strategies
 - 5.3.1.2.5.1 Mergers and Acquisitions
 - 5.3.1.2.5.2 Partnerships, Joint Ventures, Collaborations, and Alliances
 - 5.3.1.2.6 Analyst View
- 5.3.1.3 CNH Industrial N.V.
 - 5.3.1.3.1 Company Overview
 - 5.3.1.3.2 Role of CNH Industrial N.V. in the Smart Farming Market
 - 5.3.1.3.3 Product Portfolio
 - 5.3.1.3.3.1 Target Customers
 - 5.3.1.3.4 Business Strategies
 - 5.3.1.3.4.1 Product Developments
 - 5.3.1.3.5 Corporate Strategies
 - 5.3.1.3.5.1 Partnerships, Joint Ventures, Collaborations, and Alliances
 - 5.3.1.3.6 Analyst View
- 5.3.1.4 Deere & Company
 - 5.3.1.4.1 Company Overview
 - 5.3.1.4.2 Role of Deere & Company in the Smart Farming Market
 - 5.3.1.4.3 Product Portfolio
 - 5.3.1.4.3.1 Target Customers
 - 5.3.1.4.4 Business Strategies
 - 5.3.1.4.4.1 Product Developments
 - 5.3.1.4.5 Corporate Strategies
 - 5.3.1.4.5.1 Mergers and Acquisitions
 - 5.3.1.4.5.2 Partnerships, Joint Ventures, Collaborations, and Alliances

- 5.3.1.4.6 Analyst View
- 5.3.1.5 Hexagon Agriculture
 - 5.3.1.5.1 Company Overview
 - 5.3.1.5.2 Role of Hexagon Agriculture in the Smart Farming Market
 - 5.3.1.5.3 Product Portfolio
 - 5.3.1.5.3.1 Target Customers
 - 5.3.1.5.4 Business Strategies
 - 5.3.1.5.4.1 Product Developments
 - 5.3.1.5.5 Corporate Strategies
 - 5.3.1.5.5.1 Mergers and Acquisitions
 - 5.3.1.5.5.2 Partnerships, Joint Ventures, Collaborations, and Alliances
 - 5.3.1.5.6 Analyst View
- 5.3.1.6 Kubota Corporation
 - 5.3.1.6.1 Company Overview
 - 5.3.1.6.2 Role of Kubota Corporation in the Smart Farming Market
 - 5.3.1.6.3 Product Portfolio
 - 5.3.1.6.3.1 Target Customers
 - 5.3.1.6.4 Business Strategies
 - 5.3.1.6.4.1 Product Developments
 - 5.3.1.6.4.2 Market Developments
 - 5.3.1.6.5 Corporate Strategies
 - 5.3.1.6.5.1 Mergers and Acquisitions
 - 5.3.1.6.5.2 Partnerships, Joint Ventures, Collaborations, and Alliances
 - 5.3.1.6.6 Analyst View
- 5.3.1.7 Climate LLC (Bayer AG)
 - 5.3.1.7.1 Company Overview
 - 5.3.1.7.1.1 Role of Climate LLC in the Smart Farming Market
 - 5.3.1.7.1.2 Product Portfolio
 - 5.3.1.7.1.3 Target Customers
 - 5.3.1.7.1.4 Key Partners
 - 5.3.1.7.2 Business Strategies
 - 5.3.1.7.2.1 Product Developments
 - 5.3.1.7.3 Corporate Strategies
 - 5.3.1.7.3.1 Partnerships, Joint Ventures, Collaborations, and Alliances
 - 5.3.1.7.4 Analyst View
- 5.3.1.8 Trimble Inc.
 - 5.3.1.8.1 Company Overview
 - 5.3.1.8.1.1 Role of Trimble Inc. in the Global Smart Farming Market
 - 5.3.1.8.1.2 Product Portfolio

- 5.3.1.8.1.3 Target Customers
- 5.3.1.8.2 Business Strategies
 - 5.3.1.8.2.1 Product Developments
- 5.3.1.8.3 Corporate Strategies
 - 5.3.1.8.3.1 Partnerships, Joint Ventures, Collaborations, and Alliances
 - 5.3.1.8.3.2 Merger and Acquisition
- 5.3.1.8.4 Analyst View
- 5.3.1.9 BASF SE
 - 5.3.1.9.1 Company Overview
 - 5.3.1.9.2 Role of BASF SE in the Global Smart Farming Market
 - 5.3.1.9.3 Product Portfolio
 - 5.3.1.9.3.1 Target Customers
 - 5.3.1.9.3.2 Key Partners
 - 5.3.1.9.4 Business Strategies
 - 5.3.1.9.4.1 Product Developments
 - 5.3.1.9.4.2 Market Developments
 - 5.3.1.9.5 Corporate Strategies
 - 5.3.1.9.5.1 Mergers and Acquisitions
 - 5.3.1.9.5.2 Partnerships, Joint Ventures, Collaborations, and Alliances
 - 5.3.1.9.6 Analyst View
- 5.3.1.10 CropX inc.
 - 5.3.1.10.1 Company Overview
 - 5.3.1.10.2 Role of CropX inc. in the Global Smart Farming Market
 - 5.3.1.10.3 Product Portfolio
 - 5.3.1.10.3.1 Target Customers
 - 5.3.1.10.3.2 Key Partners
 - 5.3.1.10.4 Business Strategies
 - 5.3.1.10.4.1 Product Developments
 - 5.3.1.10.5 Corporate Strategies
 - 5.3.1.10.5.1 Partnerships, Collaborations, and Joint Ventures
 - 5.3.1.10.5.2 Mergers and Acquisitions
 - 5.3.1.10.6 Analyst View
- 5.3.1.11 Connecterra B.V.
 - 5.3.1.11.1 Company Overview
 - 5.3.1.11.1.1 Role of Connecterra B.V. in the Global Smart Farming Market
 - 5.3.1.11.1.2 Product Portfolio
 - 5.3.1.11.1.3 Target Customers
 - 5.3.1.11.1.4 Key Clients
 - 5.3.1.11.2 Business Strategies

- 5.3.1.11.2.1 Product Developments
- 5.3.1.11.3 Corporate Strategies
 - 5.3.1.11.3.1 Partnerships, Joint Ventures, Collaborations, and Alliances
- 5.3.1.11.4 Analyst View
- 5.3.1.12 Naio Technologies
 - 5.3.1.12.1 Company Overview
 - 5.3.1.12.2 Role of Naio Technologies in the Smart Farming Market
 - 5.3.1.12.3 Product Portfolio
 - 5.3.1.12.3.1 Target Customers
 - 5.3.1.12.4 Business Strategies
 - 5.3.1.12.4.1 Product Developments
 - 5.3.1.12.5 Corporate Strategies
 - 5.3.1.12.5.1 Partnerships, Joint Ventures, Collaborations, and Alliances
 - 5.3.1.12.6 Analyst View
- 5.3.1.13 DJI
 - 5.3.1.13.1 Company Overview
 - 5.3.1.13.2 Role of DJI in the Smart Farming Market
 - 5.3.1.13.3 Product Portfolio
 - 5.3.1.13.3.1 Target Customers
 - 5.3.1.13.4 Analyst View
- 5.3.1.14 Signify Holding
 - 5.3.1.14.1 Company Overview
 - 5.3.1.14.2 Role of Signify Holding in the Smart Farming Market
 - 5.3.1.14.3 Product Portfolio
 - 5.3.1.14.3.1 Target Customers
 - 5.3.1.14.4 Analyst View
- 5.3.1.15 Osram Licht AG
 - 5.3.1.15.1 Company Overview
 - 5.3.1.15.2 Role of Osram Licht AG in the Smart Farming Market
 - 5.3.1.15.3 Product Portfolio
 - 5.3.1.15.3.1 Target Customers
 - 5.3.1.15.4 Business Strategies
 - 5.3.1.15.4.1 Product Developments
 - 5.3.1.15.5 Analyst View
- 5.3.2 Livestock Monitoring and Management
 - 5.3.2.1 Afimilk Ltd.
 - 5.3.2.1.1 Company Overview
 - 5.3.2.1.2 Role of Afimilk Ltd. in the Smart Farming Market
 - 5.3.2.1.3 Product Portfolio

- 5.3.2.1.3.1 Target Customers
- 5.3.2.1.4 Business Strategies
 - 5.3.2.1.4.1 Product Developments
- 5.3.2.1.5 Corporate Strategies
 - 5.3.2.1.5.1 Partnerships, Joint Ventures, Collaborations, and Alliances
- 5.3.2.1.6 Analyst View
- 5.3.2.2 Allflex USA Inc.
 - 5.3.2.2.1 Company Overview
 - 5.3.2.2.2 Role of Allflex USA Inc. in the Smart Farming Market
 - 5.3.2.2.3 Product Portfolio
 - 5.3.2.2.3.1 Target Customers
 - 5.3.2.2.4 Business Strategies
 - 5.3.2.2.4.1 Product Developments
 - 5.3.2.2.5 Corporate Strategies
 - 5.3.2.2.5.1 Mergers and Acquisitions
 - 5.3.2.2.6 Analyst View
- 5.3.2.3 Nedap N.V.
 - 5.3.2.3.1 Company Overview
 - 5.3.2.3.2 Role of Nedap N.V. in the Smart Farming Market
 - 5.3.2.3.3 Product Portfolio
 - 5.3.2.3.3.1 Target Customers
 - 5.3.2.3.3.2 Key Clients
 - 5.3.2.3.4 Business Strategies
 - 5.3.2.3.4.1 Product Developments
 - 5.3.2.3.5 Analyst View
- 5.3.2.4 Cargill, Incorporated
 - 5.3.2.4.1 Company Overview
 - 5.3.2.4.1.1 Role of Cargill, Incorporated in the Global Smart Farming Market
 - 5.3.2.4.1.2 Product Portfolio
 - 5.3.2.4.1.3 Target Customers
 - 5.3.2.4.1.4 Key Clients
 - 5.3.2.4.2 Business Strategies
 - 5.3.2.4.2.1 Product Developments
 - 5.3.2.4.2.2 Business Expansion
 - 5.3.2.4.3 Corporate Strategies
 - 5.3.2.4.3.1 Partnerships, Joint Ventures, Collaborations, and Alliances
 - 5.3.2.4.4 Analyst View
- 5.3.2.5 GEA Group Ag
 - 5.3.2.5.1 Company Overview

- 5.3.2.5.1.1 Role of GEA Group Ag in the Global Smart Farming Market
- 5.3.2.5.1.2 Product Portfolio
- 5.3.2.5.1.3 Target Customers
- 5.3.2.5.1.4 Key Clients
- 5.3.2.5.2 Business Strategies
 - 5.3.2.5.2.1 Product Developments
- 5.3.2.5.3 Corporate Strategies
 - 5.3.2.5.3.1 Partnerships, Joint Ventures, Collaborations, and Alliances
- 5.3.2.5.4 Analyst View
- 5.3.3 Aquaculture
 - 5.3.3.1 AKVA Group ASA
 - 5.3.3.1.1 Company Overview
 - 5.3.3.1.2 Role of AKVA Group ASA in the Smart Farming Market
 - 5.3.3.1.3 Product Portfolio
 - 5.3.3.1.3.1 Target Customers
 - 5.3.3.1.4 Corporate Strategies
 - 5.3.3.1.4.1 Mergers and Acquisitions
 - 5.3.3.1.5 Analyst View
 - 5.3.3.2 Eruvaka Technologies
 - 5.3.3.2.1 Company Overview
 - 5.3.3.2.2 Role of Eruvaka Technologies in the Smart Farming Market
 - 5.3.3.2.3 Product Portfolio
 - 5.3.3.2.3.1 Target Customers
 - 5.3.3.2.4 Analyst View
 - 5.3.3.3 AquaManager (Integrated Information Systems S.A.)
 - 5.3.3.3.1 Company Overview
 - 5.3.3.3.2 Role of AquaManager in the Smart Farming Market
 - 5.3.3.3.3 Product Portfolio
 - 5.3.3.3.3.1 Target Customers
 - 5.3.3.3.3.2 Key Clients
 - 5.3.3.3.4 Corporate Strategies
 - 5.3.3.3.4.1 Partnerships, Joint Ventures, Collaborations, and Alliances
 - 5.3.3.3.5 Analyst View

6 RESEARCH METHODOLOGY

6.1 Data Sources

- 6.1.1 Primary Data Sources
- 6.1.2 Secondary Data Sources

6.1.3 Data Triangulation
6.2 Market estimation and Forecast

List Of Figures

LIST OF FIGURES

Figure 1: Microeconomic Indicators Impacting the Smart Farming Market

Figure 2: Market Dynamics of the Global Smart Farming Market, Drivers, Challenges, and Opportunities

Figure 3: Global Smart Farming Market, \$Billion, 2021-2027

Figure 4: Global Smart Farming Market (by Application), \$Billion, 2021 and 2027

Figure 5: Global Smart Farming Market (by Product), 2021

Figure 6: Global Smart Farming Market (by Region), \$Billion, 2021

Figure 7: Global Smart Farming Market Coverage

Figure 8: Characteristics of Smart Farming

Figure 9: Smart Farming Architecture

Figure 10: Applications of 5G in Smart Farming Operations

Figure 11: Employment in Agriculture in the World (Percentage of Total Employment), 2015-2019

Figure 12: Employment in Agriculture for European Countries (Percentage of Total Employment), 2015-2019

Figure 13: Trends in Agriculture Land Use Globally (% of Land Area), 2001-2020

Figure 14: Soil Erosion Project - Africa Wood Grow in Kenyan Farmlands

Figure 15: Agriculture Sector Emissions, 2018

Figure 16: Research Articles Publications Related to Livestock Tracking, 2010-2020

Figure 17: Basic Infrastructural Requirements of Smart Farming Ecosystem

Figure 18: Agriculture Revenue Per Labour, 2017

Figure 19: Malware Attacks on Agriculture Industry Globally, Million, 2019-2020

Figure 20: Product Development and Innovation (by Company), January 2017-January 2023

Figure 21: Business Expansion and Investments (by Company), January 2017- January 2023

Figure 22: Mergers and Acquisitions (by Company), January 2017-January 2023

Figure 23: Partnerships, Joint Ventures, Collaborations, and Alliances (by Company), January 2017-January 2023

Figure 24: Agreement and Others (by Company), January 2017-January 2023

Figure 25: Snapshot of Corporate Strategies Adopted by the Players in Global Smart Farming Market

Figure 26: Applications of Blockchain in Agricultural Operations

Figure 27: FarmSustainaBI Project

Figure 28: Digital Traceability in Rice Value Chain, Ivory Coast-CropIn Technology

Figure 29: Climate-smart agriculture

Figure 30: Remote Monitoring of Grape Crops for Disease and Pest Management-Infosys

Figure 31: Automated Irrigation System Development-Krish Compusoft Services

Figure 32: Smart Farming Technologies Implementation on Rice Yield - Atilze

Figure 33: Reduction of Input Resources - Zerynth S.p.A.

Figure 34: Prediction of Yield Production and Tracking of Farm Cultivation – Extentia Information Technology

Figure 35: Total Investment and Number of Funding Deals, January 2020-December 2021

Figure 36: Top Funding Deals in Novel Farming Systems and Farm Management Software, Sensing, and IoT (by Funding Amount), 2021

Figure 37: Funding (by Technology), 2021

Figure 38: Funding (by Year), 2020-2021

Figure 39: Smart Farming Applications

Figure 40: Adoption of Key Precision Agriculture Technologies by the U.S. and Other Global Countries, 2021

Figure 41: Precision Agriculture Cycle

Figure 42: Smart Irrigation Technology Deployment in India

Figure 43: Livestock Management Cycle

Figure 44: Smart Aquaculture Cycle

Figure 45: Smart Farming Market (by Product)

Figure 46: Smart Farming Solution Structure

Figure 47: Patents Filed or Granted for Global Smart Farming Market, January 2018-December 2022

Figure 48: Patent Analysis (by Application), January 2018-December 2022

Figure 49: Patent Analysis (by Organization), January 2018-December 2022

Figure 50: Patent Analysis (by Patent Office), January 2018-December 2022

Figure 51: Market for Various Technologies and Methods in Agriculture

Figure 52: Global Agriculture Goals Achieved through Smart Farming

Figure 53: History of Agricultural Evolution

Figure 54: Smart Farming Technologies in Agricultural Value Chain

Figure 55: Competitive Market High and Low Matrix for Precision Farming Companies

Figure 56: Competitive Market High and Low Matrix for Livestock Monitoring and Management Companies

Figure 57: Market Share Analysis of Precision Farming Equipment Manufacturers, 2021

Figure 58: Share Analysis of Livestock Monitoring and Management Solution Providers, 2021

Figure 59: Trends in Adoption of Corporate Strategies, 2017, 2018, 2020, and 2021

Figure 60: Trends in Adoption of Corporate Strategies, 2019-2020

Figure 61: Trends in Adoption of Corporate Strategies, 2019-2022

Figure 62: Trends in Adoption of Corporate Strategies, 2019-2022

Figure 63: Trends in Adoption of Corporate Strategies, 2020-2022

Figure 64: Data Triangulation

Figure 65: Top-Down and Bottom-Up Approach

Figure 66: Assumptions and Limitations

List Of Tables

LIST OF TABLES

Table 1: Key Consortiums and Associations in the Global Smart Farming Market

Table 2: Key Regulatory Bodies

Table 3: Key Government Programs

Table 4: Government Initiatives for Sustainable Food Production

Table 5: Precision Agriculture Benefits

Table 6: Internet and Electricity Access in Key Countries, 2020

Table 7: Key Start-Ups in the Global Smart Farming Market

Table 8: Major Precision Irrigation Methods for the Global Smart Farming Market

Table 9: Key Precision Irrigation Companies

Table 10: Key Yield Monitoring Technologies Utilized in Global Smart Farming Market

Table 11: Key Market Players in Yield Monitoring and Crop Scouting

Table 12: Major Precision Planting Technologies Utilized in Precision Planting in the Global Smart Farming Market

Table 13: Key Players Offering Precision Planting Services

Table 14: Key Precision Spraying Technologies Utilized in the Global Smart Farming Market

Table 15: Key Players Offering Precision Spraying Services

Table 16: Key Precision Fertilization Technologies Utilized in the Global Smart Farming Market

Table 17: Key Players Offering Precision Fertilization Services

Table 18: Key Farm Management Technologies Utilized in the Global Smart Farming Market

Table 19: Key Companies Providing Farm Management Services

Table 20: Key Milk Harvesting System Companies

Table 21: Key Animal Health Monitoring and Comfort Companies

Table 22: Key Feeding Management Companies

Table 23: Key Livestock Tracking Products Companies

Table 24: Key Feed Management Companies

Table 25: Key Aquatic Species Tracking and Navigation Companies

Table 26: Key Water Quality Management Companies

Table 27: Key Other Applications Companies

Table 28: Global Smart Farming Market (by Application), \$Million, 2021-2027

Table 29: Key Display/Yield Monitor Companies

Table 30: Key Flow and Application Rate Control Valves Companies

Table 31: Key Farm Computers and Mobile Devices Companies

Table 32: Key Agricultural Camera Companies

Table 33: Key RFID Tag and Reader Companies

Table 34: Key Guidance and Steering Systems Companies

Table 35: Key GPS/GNSS System Companies

Table 36: Key Other Hardware Companies

Table 37: Key Smart Farming Software Companies

Table 38: Key Companies Providing Farm Operation Management Software

Table 39: Key Companies Providing Hardware Control Application Software

Table 40: Key Companies Providing Data and Predictive Analytics Software

Table 41: Global Smart Farming Market (by Product), \$Million, 2021-2027

Table 42: Global Smart Farming Market (by Software Type), \$Million, 2021-2027

Table 43: Global Smart Farming Market (by Hardware Type), \$Million, 2021-2027

Table 44: Global Smart Farming Market (by Hardware Type), Thousand Units, 2021-2027

Table 45: Primary Application or Technology Focused on by Key Players in Patent Filing

Table 46: Global Smart Farming Market (by Region), \$Millions, 2021-2027

Table 47: North America Smart Farming Market (by Application), \$Million, 2021-2027

Table 48: North America Smart Farming Market (by Product), \$Million, 2021-2027

Table 49: North America Smart Farming Market (by Software Type), \$Million, 2021-2027

Table 50: North America Smart Farming Market (by Hardware Type), \$Million, 2021-2027

Table 51: North America Smart Farming Market (by Hardware Type), Thousand Units, 2021-2027

Table 52: North America Smart Farming Market (by Country), \$Million, 2021-2027

Table 53: U.S. Smart Farming Market (by Application), \$Million, 2021-2027

Table 54: U.S. Smart Farming Market (by Product), \$Million, 2021-2027

Table 55: U.S. Smart Farming Market (by Software Type), \$Million, 2021-2027

Table 56: U.S. Smart Farming Market (by Hardware Type), \$Million, 2021-2027

Table 57: U.S. Smart Farming Market (by Hardware Type), Thousand Units, 2021-2027

Table 58: Canada Smart Farming Market (by Application), \$Million, 2021-2027

Table 59: Canada Smart Farming Market (by Product), \$Million, 2021-2027

Table 60: Canada Smart Farming Market (by Software Type), \$Million, 2021-2027

Table 61: Canada Smart Farming Market (by Hardware Type), \$Million, 2021-2027

Table 62: Canada Smart Farming Market (by Hardware Type), Thousand Units, 2021-2027

Table 63: Mexico Smart Farming Market (by Application), \$Million, 2021-2027

Table 64: Mexico Smart Farming Market (by Product), \$Million, 2021-2027

Table 65: Mexico Smart Farming Market (by Software Type), \$Million, 2021-2027

Table 66: Mexico Smart Farming Market (by Hardware Type), \$Million, 2021-2027

Table 67: Mexico Smart Farming Market (by Hardware Type), Thousand Units, 2021-2027

Table 68: Europe Smart Farming Market (by Application), \$Million, 2021-2027

Table 69: Europe Smart Farming Market (by Product), \$Million, 2021-2027

Table 70: Europe Smart Farming Market (by Software Type), \$Million, 2021-2027

Table 71: Europe Smart Farming Market (by Hardware Type), \$Million, 2021-2027

Table 72: Europe Smart Farming Market (by Hardware Type), Thousand Units, 2021-2027

Table 73: Europe Smart Farming Market (by Country), \$Million, 2021-2027

Table 74: Germany Smart Farming Market (by Application), \$Million, 2021-2027

Table 75: Germany Smart Farming Market (by Product), \$Million, 2021-2027

Table 76: Germany Smart Farming Market (by Software Type), \$Million, 2021-2027

Table 77: Germany Smart Farming Market (by Hardware Type), \$Million, 2021-2027

Table 78: Germany Smart Farming Market (by Hardware Type), Thousand Units, 2021-2027

Table 79: France Smart Farming Market (by Application), \$Million, 2021-2027

Table 80: France Smart Farming Market (by Product), \$Million, 2021-2027

Table 81: France Smart Farming Market (by Software Type), \$Million, 2021-2027

Table 82: France Smart Farming Market (by Hardware Type), \$Million, 2021-2027

Table 83: France Smart Farming Market (by Hardware Type), Thousand Units, 2021-2027

Table 84: Netherlands Smart Farming Market (by Application), \$Million, 2021-2027

Table 85: Netherlands Smart Farming Market (by Product), \$Million, 2021-2027

Table 86: Netherlands Smart Farming Market (by Software Type), \$Million, 2021-2027

Table 87: Netherlands Smart Farming Market (by Hardware Type), \$Million, 2021-2027

Table 88: Netherlands Smart Farming Market (by Hardware Type), Thousand Units, 2021-2027

Table 89: Italy Smart Farming Market (by Application), \$Million, 2021-2027

Table 90: Italy Smart Farming Market (by Product), \$Million, 2021-2027

Table 91: Italy Smart Farming Market (by Software Type), \$Million, 2021-2027

Table 92: Italy Smart Farming Market (by Hardware Type), \$Million, 2021-2027

Table 93: Italy Smart Farming Market (by Hardware Type), Thousand Units, 2021-2027

Table 94: Spain Smart Farming Market (by Application), \$Million, 2021-2027

Table 95: Spain Smart Farming Market (by Product), \$Million, 2021-2027

Table 96: Spain Smart Farming Market (by Software Type), \$Million, 2021-2027

Table 97: Spain Smart Farming Market (by Hardware Type), \$Million, 2021-2027

Table 98: Spain Smart Farming Market (by Hardware Type), Thousand Units,

2021-2027

Table 99: Greece Smart Farming Market (by Application), \$Million, 2021-2027

Table 100: Greece Smart Farming Market (by Product), \$Million, 2021-2027

Table 101: Greece Smart Farming Market (by Software Type), \$Million, 2021-2027

Table 102: Greece Smart Farming Market (by Hardware Type), \$Million, 2021-2027

Table 103: Greece Smart Farming Market (by Hardware Type), Thousand Units, 2021-2027

Table 104: Switzerland Smart Farming Market (by Application), \$Million, 2021-2027

Table 105: Switzerland Smart Farming Market (by Product), \$Million, 2021-2027

Table 106: Switzerland Smart Farming Market (by Software Type), \$Million, 2021-2027

Table 107: Switzerland Smart Farming Market (by Hardware Type), \$Million, 2021-2027

Table 108: Switzerland Smart Farming Market (by Hardware Type), Thousand Units, 2021-2027

Table 109: Ukraine Smart Farming Market (by Application), \$Million, 2021-2027

Table 110: Ukraine Smart Farming Market (by Product), \$Million, 2021-2027

Table 111: Ukraine Smart Farming Market (by Software Type), \$Million, 2021-2027

Table 112: Ukraine Smart Farming Market (by Hardware Type), \$Million, 2021-2027

Table 113: Ukraine Smart Farming Market (by Hardware Type), Thousand Units, 2021-2027

Table 114: Belgium Smart Farming Market (by Application), \$Million, 2021-2027

Table 115: Belgium Smart Farming Market (by Product), \$Million, 2021-2027

Table 116: Belgium Smart Farming Market (by Software Type), \$Million, 2021-2027

Table 117: Belgium Smart Farming Market (by Hardware Type), \$Million, 2021-2027

Table 118: Belgium Smart Farming Market (by Hardware Type), Thousand Units, 2021-2027

Table 119: Rest-of-Europe Smart Farming Market (by Application), \$Million, 2021-2027

Table 120: Rest-of-Europe Smart Farming Market (by Product), \$Million, 2021-2027

Table 121: Rest-of-Europe Smart Farming Market (by Software Type), \$Million, 2021-2027

Table 122: Rest-of-Europe Smart Farming Market (by Hardware Type), \$Million, 2021-2027

Table 123: Rest-of-Europe Smart Farming Market (by Hardware Type), Thousand Units, 2021-2027

Table 124: U.K. Smart Farming Market (by Application), \$Million, 2021-2027

Table 125: U.K. Smart Farming Market (by Product), \$Million, 2021-2027

Table 126: U.K. Smart Farming Market (by Software Type), \$Million, 2021-2027

Table 127: U.K. Smart Farming Market (by Hardware Type), \$Million, 2021-2027

Table 128: U.K. Smart Farming Market (by Hardware Type), Thousand Units, 2021-2027

- Table 129: China Smart Farming Market (by Application), \$Million, 2021-2027
- Table 130: China Smart Farming Market (by Product), \$Million, 2021-2027
- Table 131: China Smart Farming Market (by Software Type), \$Million, 2021-2027
- Table 132: China Smart Farming Market (by Hardware Type), \$Million, 2021-2027
- Table 133: China Smart Farming Market (by Hardware Type), Thousand Units, 2021-2027
- Table 134: Asia-Pacific Smart Farming Market (by Application), \$Million, 2021-2027
- Table 135: Asia-Pacific Smart Farming Market (by Product), \$Million, 2021-2027
- Table 136: Asia-Pacific Smart Farming Market (by Software Type), \$Million, 2021-2027
- Table 137: Asia-Pacific Smart Farming Market (by Hardware Type), \$Million, 2021-2027
- Table 138: Asia-Pacific Smart Farming Market (by Hardware Type), Thousand Units, 2021-2027
- Table 139: Asia-Pacific Smart Farming Market (by Country), \$Million, 2021-2027
- Table 140: Japan Smart Farming Market (by Application), \$Million, 2021-2027
- Table 141: Japan Smart Farming Market (by Product), \$Million, 2021-2027
- Table 142: Japan Smart Farming Market (by Software Type), \$Million, 2021-2027
- Table 143: Japan Smart Farming Market (by Hardware Type), \$Million, 2021-2027
- Table 144: Japan Smart Farming Market (by Hardware Type), Thousand Units, 2021-2027
- Table 145: India Smart Farming Market (by Application), \$Million, 2021-2027
- Table 146: India Smart Farming Market (by Product), \$Million, 2021-2027
- Table 147: India Smart Farming Market (by Software Type), \$Million, 2021-2027
- Table 148: India Smart Farming Market (by Hardware Type), \$Million, 2021-2027
- Table 149: India Smart Farming Market (by Hardware Type), Thousand Units, 2021-2027
- Table 150: Australia and New Zealand Smart Farming Market (by Application), \$Million, 2021-2027
- Table 151: Australia and New Zealand Smart Farming Market (by Product), \$Million, 2021-2027
- Table 152: Australia and New Zealand Smart Farming Market (by Software Type), \$Million, 2021-2027
- Table 153: Australia and New Zealand Smart Farming Market (by Hardware Type), \$Million, 2021-2027
- Table 154: Australia and New Zealand Smart Farming Market (by Hardware Type), Thousand Units, 2021-2027
- Table 155: Thailand Smart Farming Market (by Application), \$Million, 2021-2027
- Table 156: Thailand Smart Farming Market (by Product), \$Million, 2021-2027
- Table 157: Thailand Smart Farming Market (by Software Type), \$Million, 2021-2027
- Table 158: Thailand Smart Farming Market (by Hardware Type), \$Million, 2021-2027

Table 159: Thailand Smart Farming Market (by Hardware Type), Thousand Units, 2021-2027

Table 160: South Korea Smart Farming Market (by Application), \$Million, 2021-2027

Table 161: South Korea Smart Farming Market (by Product), \$Million, 2021-2027

Table 162: South Korea Smart Farming Market (by Software Type), \$Million, 2021-2027

Table 163: South Korea Smart Farming Market (by Hardware Type), \$Million, 2021-2027

Table 164: South Korea Smart Farming Market (by Hardware Type), Thousand Units, 2021-2027

Table 165: Rest-of-Asia-Pacific Smart Farming Market (by Application), \$Million, 2021-2027

Table 166: Rest-of-Asia-Pacific Smart Farming Market (by Product), \$Million, 2021-2027

Table 167: Rest-of-Asia-Pacific Smart Farming Market (by Software Type), \$Million, 2021-2027

Table 168: Rest-of-Asia-Pacific Smart Farming Market (by Hardware Type), \$Million, 2021-2027

Table 169: Rest-of-Asia-Pacific Smart Farming Market (by Hardware Type), Thousand Units, 2021-2027

Table 170: Middle East and Africa Smart Farming Market (by Application), \$Million, 2021-2027

Table 171: Middle East and Africa Smart Farming Market (by Product), \$Million, 2021-2027

Table 172: Middle East and Africa Smart Farming Market (by Software Type), \$Million, 2021-2027

Table 173: Middle East and Africa Smart Farming Market (by Hardware Type), \$Million, 2021-2027

Table 174: Middle East and Africa Smart Farming Market (by Hardware Type), Thousand Units, 2021-2027

Table 175: Middle East and Africa Smart Farming Market (by Country), \$Million, 2021-2027

Table 176: Israel Smart Farming Market (by Application), \$Million, 2021-2027

Table 177: Israel Smart Farming Market (by Product), \$Million, 2021-2027

Table 178: Israel Smart Farming Market (by Software Type), \$Million, 2021-2027

Table 179: Israel Smart Farming Market (by Hardware Type), \$Million, 2021-2027

Table 180: Israel Smart Farming Market (by Hardware Type), Thousand Units, 2021-2027

Table 181: South Africa Smart Farming Market (by Application), \$Million, 2021-2027

Table 182: South Africa Smart Farming Market (by Product), \$Million, 2021-2027

Table 183: South Africa Smart Farming Market (by Software Type), \$Million, 2021-2027

Table 184: South Africa Smart Farming Market (by Hardware Type), \$Million, 2021-2027

Table 185: South Africa Smart Farming Market (by Hardware Type), Thousand Units, 2021-2027

Table 186: Turkey Smart Farming Market (by Application), \$Million, 2021-2027

Table 187: Turkey Smart Farming Market (by Product), \$Million, 2021-2027

Table 188: Turkey Smart Farming Market (by Software Type), \$Million, 2021-2027

Table 189: Turkey Smart Farming Market (by Hardware Type), \$Million, 2021-2027

Table 190: Turkey Smart Farming Market (by Hardware Type), Thousand Units, 2021-2027

Table 191: Rest-of-Middle East and Africa Smart Farming Market (by Application), \$Million, 2021-2027

Table 192: Rest-of-Middle East and Africa Smart Farming Market (by Product), \$Million, 2021-2027

Table 193: Rest-of-Middle East and Africa Smart Farming Market (by Software Type), \$Million, 2021-2027

Table 194: Rest-of-Middle East and Africa Smart Farming Market (by Hardware Type), \$Million, 2021-2027

Table 195: Rest-of-Middle East and Africa Smart Farming Market (by Hardware Type), Thousand Units, 2021-2027

Table 196: South America Smart Farming Market (by Application), \$Million, 2021-2027

Table 197: South America Smart Farming Market (by Product), \$Million, 2021-2027

Table 198: South America Smart Farming Market (by Software Type), \$Million, 2021-2027

Table 199: South America Smart Farming Market (by Hardware Type), \$Million, 2021-2027

Table 200: South America Smart Farming Market (by Hardware Type), Thousand Units, 2021-2027

Table 201: South America Smart Farming Market (by Country), \$Million, 2021-2027

Table 202: Brazil Smart Farming Market (by Application), \$Million, 2021-2027

Table 203: Brazil Smart Farming Market (by Product), \$Million, 2021-2027

Table 204: Brazil Smart Farming Market (by Software Type), \$Million, 2021-2027

Table 205: Brazil Smart Farming Market (by Hardware Type), \$Million, 2021-2027

Table 206: Brazil Smart Farming Market (by Hardware Type), Thousand Units, 2021-2027

Table 207: Rest-of-South America Smart Farming Market (by Application), \$Million, 2021-2027

Table 208: Rest-of-South America Smart Farming Market (by Product), \$Million,

2021-2027

Table 209: Rest-of-South America Smart Farming Market (by Software Type), \$Million, 2021-2027

Table 210: Rest-of-South America Smart Farming Market (by Hardware Type), \$Million, 2021-2027

Table 211: Rest-of-South America Smart Farming Market (by Hardware Type), Thousand Units, 2021-2027

Table 212: Ag Leader Technology: Product Portfolio

Table 213: Ag Leader Technology: Pricing Analysis

Table 214: Ag Leader Technology: Product Development

Table 215: AGCO Corporation: Product Portfolio

Table 216: Product Developments

Table 217: Market Development

Table 218: Mergers and Acquisitions

Table 219: Partnership, Investment, and Collaboration

Table 220: CNH Industrial N.V.: Product Portfolio

Table 221: Product Developments

Table 222: Mergers and Acquisitions

Table 223: Partnership, Investment, and Collaboration

Table 224: Deere & Company: Product Portfolio

Table 225: Deere & Company: Pricing Analysis

Table 226: Product Developments

Table 227: Mergers and Acquisitions

Table 228: Partnership and Collaboration

Table 229: Hexagon Agriculture: Product Portfolio

Table 230: Product Developments

Table 231: Mergers and Acquisitions

Table 232: Partnership and Collaboration

Table 233: Kubota Corporation: Product Portfolio

Table 234: Product Developments

Table 235: Kubota Corporation: Business Expansion

Table 236: Mergers and Acquisitions

Table 237: Partnership, Investment, and Collaboration

Table 238: Climate LLC: Product Portfolio

Table 239: Climate LLC: Pricing Analysis

Table 240: Product Developments

Table 241: Climate LLC: Partnerships, Joint Ventures, Collaborations, and Alliances

Table 242: Trimble Inc.: Product Portfolio

Table 243: Product Developments

Table 244: Trimble Inc.: Partnerships, Joint Ventures, Collaborations, and Alliances

Table 245: BASF SE: Product Portfolio

Table 246: Product Developments

Table 247: BASF SE: Market Developments

Table 248: BASF SE: Mergers and Acquisitions

Table 249: BASF SE: Partnerships, Joint Ventures, Collaborations, and Alliances

Table 250: CropX inc.: Product Portfolio

Table 251: Product Developments

Table 252: CropX inc.: Partnerships, Collaborations, and Joint Ventures

Table 253: CropX inc.: Mergers and Acquisitions

Table 254: Connecterra B.V.: Product Portfolio

Table 255: Product Developments

Table 256: Connecterra B.V.: Partnerships, Joint Ventures, Collaborations, and Alliances

Table 257: Naio Technologies: Product Portfolio

Table 258: Product Developments

Table 259: Partnership and Collaboration

Table 260: DJI: Product Portfolio

Table 261: Signify Holding: Product Portfolio

Table 262: Osram Licht AG: Product Portfolio

Table 263: Product Developments

Table 264: Afimilk Ltd.: Product Portfolio

Table 265: Product Developments

Table 266: Partnership and Collaboration

Table 267: Allflex USA Inc.: Product Portfolio

Table 268: Product Developments

Table 269: Mergers and Acquisitions

Table 270: Nedap N.V.: Product Portfolio

Table 271: Product Developments

Table 272: Cargill, Incorporated: Product Portfolio

Table 273: Product Developments

Table 274: Cargill, Incorporated: Business Expansion

Table 275: Cargill, Incorporated: Partnerships, Joint Ventures, Collaborations, and Alliances

Table 276: GEA Group Ag: Product Portfolio

Table 277: Product Developments

Table 278: GEA Group Ag: Partnerships, Joint Ventures, Collaborations, and Alliances

Table 279: AKVA Group ASA: Product Portfolio

Table 280: Mergers and Acquisitions

Table 281: Eruvaka Technologies: Product Portfolio

Table 282: AquaManager: Product Portfolio

Table 283: AquaManager: Partnerships, Joint Ventures, Collaborations, and Alliances

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