“Sustainable Pharmaceutical Packaging Market, till 2035”

Dissertation submitted in partial fulfilment of the requirements for the award of the degree of

Masters of Science in Biotechnology

By

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Under the Guidance of

Ms. Rupanshi Sharma

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and

Dr. Ashok Kumar Nadda (JUIT)

To

DEPARTMENT OF BIOTECHNOLOGY AND BIOINFORMATICS

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY

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DECLARATION

I hereby declare that the work presented in this report entitled "**Sustainable Pharmaceutical Packaging Market, till 2035**" for partial fulfilment for the award of degree of **Master of Science in Biotechnology** submitted in the Department of Biotechnology & Bioinformatics, Jaypee University of Information Technology, Waknaghat is an authentic record of my work carried out at Roots Analysis Pvt. Ltd. over a period from January 2024 to June 2024 under the guidance of Rupanshi Sharma (Project Manager) and Dr. Ashok Kumar Nadda (Assistant Professor, BT&BI, JUIT).

The matter embodied in the report has not been submitted for the award of any other degree or diploma.

(Student Signature)

Sanskriti Sauhta

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This is to certify that the above statement made by the candidate is true to the best of my knowledge.

(Supervisor Signature)

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Assistant Professor,

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Dated: 17 May, 2024

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Rupanshi Sharma

Project Manager

Roots Analysis Pvt. Ltd.

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This is to certify that the work reported in the Dissertation entitled '**Sustainable Pharmaceutical Packaging Market, till 2035'**submitted by **Sanskriti Sauhta** for partial fulfilment for the award of degree of Masters of Science in Biotechnology from **Jaypee University of Information & Technology, Waknaghat** has been carried out under my supervision. This report was not submitted to any other University or Institute in full or in part for the award of any other degree, certificate or other titles.

Rupanshi Sharma

Project Manager

Roots Analysis Pvt. Ltd

Dr. Ashok Kumar Nadda (Guide)

Assistant Professor,

Jaypee University of Information Technology

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Sanskriti Sauhta

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About Roots Analysis Private Limited

Roots Analysis Pvt. Ltd. is a business research and consulting firm which specializes in providing in-depth business research and consulting services for the pharmaceutical industry. Focused on providing an informed and impartial view on key challenges facing the industry, the research is primarily driven by an in-depth analysis covering the following parameters:

- Research and development
- Existing market landscape
- Future Commercial potential
- Regulatory concerns
- Regional growth drivers
- Risks and opportunities

The firm specializes in analyzing areas which have lacked quality research so far or require more focused understanding within the broader industry. Apart from writing reports on identified areas, the company also provides bespoke research / consulting services dedicated to serve our clients in the best possible way.

The business reports highlight trends ranging from commercial success / potential, technological developments and outlook built around opportunities and threats. The company majorly focus on areas spanning the following domains:

- Therapeutic segments
- Emerging technologies
- Medical devices
- Drug Delivery
- Clinical Trials

Research Methodology

Most of the data presented in this report has been gathered via secondary and primary research. We have conducted interviews with experts in the area (academia, industry, medical practice and other associations) to solicit their opinions on emerging trends in the market. This is primarily useful for us to draw out our own opinion on how the market will shape up across different regions and technology segments. Where possible, the available data has been checked for accuracy from multiple sources of information.

The secondary sources of information include:

- Company's Annual reports
- Investor presentations
- SEC filings
- Industry databases
- News releases from company websites
- Government policy documents
- Industry analysts' views
- Research articles; Blogs; Press articles
- Company website

Work Program

While the focus has been on providing a comprehensive view on the ongoing technological innovations, the report **"Sustainable Pharmaceutical Packaging Market, till 2035"** also provides an independent view on research and development and future commercial potential emerging in the industry. This opinion is solely based on our knowledge, research and understanding of the relevant market gathered from various secondary and primary sources of information.

The course of my internship at Roots Analysis started on 2nd January 2024. I was involved in a project, on which I worked for 5 months. The training program is structured as follows:

- The main objective of this report is to build a comprehensive database of Sustainable packaging providers along with type of services / products offered by them, funding analysis and the likely growth of partnership activity in this domain, by using available

data of various companies on company's website, LinkedIn profiles and other publicly available sources.

- Further, an analysis around this information will be presented to provide a high-level quick overview of the ongoing activity in this domain.
- Collection of company specific data.
- Introduction chapter on sustainable pharmaceutical packaging, emerging needs and various advantages associated with it.
- Detailed profiling of key stakeholders in this domain.
- Capturing partnership and funding database.
- Screening and analysis of related partnerships and funding.
- Finding the contact details of the prominent speakers in conferences and contacts of the key individuals belonging to players in this domain.
- Concluding the report with its insights, learnings, outcomes and the future scope.

Abstract

The project "**Sustainable Pharmaceutical Packaging Market, till 2035**" broadly features a detailed assessment of players engaged in offering products and / or services for sustainable, biodegradable, and eco-friendly packaging in the healthcare sector. The study offers a comprehensive analysis of the main factors and trends associated with this field.

The report provides a general overview on the pharmaceutical packaging, the different types of pharmaceutical packaging and various sustainable pharmaceutical packaging solutions / services that are currently available in the market. The research also report provides a thorough study on the present market landscape of sustainable packaging providers that are engaged in providing products and /or services in this domain. Further, the report also provides a detailed analysis of the several partnerships and fundings that have been inked / raised by sustainable packaging providers in the healthcare sector. Extensive primary and secondary research was conducted to collect relevant information on the topic.

Upon finishing the study, a database was created in excel featuring information on more than 122 sustainable packaging providers, along with the product / services information offered by them. It includes an in-depth analysis of these players based on their establishment year, location of headquarters, company size, type of offerings, ISO certifications accredited, type of eco-friendly packaging, origin of packaging material, type of packaging material used, type of packaging and packaging applications. Company specific details captured, includes company's establishment year, employee strength, location of headquarters, and leading players based on the number of products they offer. Furthermore, an analysis was conducted to depict the current status of the industry.

Chapter 1

Introduction

Chapter Overview

Packaging is the process of enclosing a product in a container in order to protect and store it. Packaging plays a significant role in maintaining the integrity and strength of a product within the pharmaceutical industry. The type of raw material utilized for packaging highly depends on the type of product / drug enclosed. Glass, plastic, metals, cardboard and wood are some of the most commonly used raw materials for pharmaceutical packaging. However, a huge amount of waste is generated due to these conventional raw materials primarily due to their inability to decompose naturally. It is worth highlighting that over 500 million tonnes of waste is generated through pharmaceutical packaging globally. [1] Further, the global demand for pharmaceutical products is continuously increasing, imposing a burden on the environment. Therefore, there is a menacing need to shift towards alternative sustainable, eco-friendly and biodegradable raw materials for packaging. [2], [3]

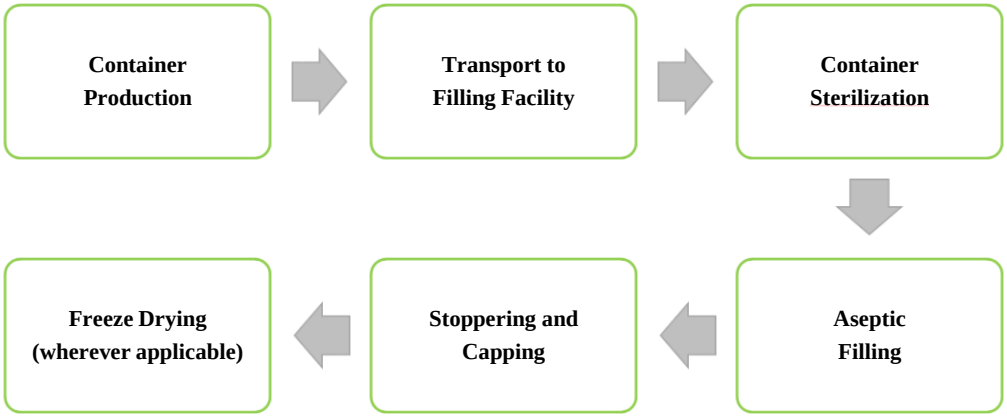
The adoption of recycled paper, plastic, and cardboard has emerged as a promising substitute for traditional pharmaceutical packaging materials. These materials have helped in optimizing both cost and sustainability of the process. Further, these materials have also been formulated to decompose naturally, leaving no harmful residues. This has helped in substantially lowering the environmental impact, when compared to other traditional petroleum plastics.[4] This chapter provides a brief overview of the pharmaceutical packaging, along with their advantages. Further, we have highlighted the different types of pharmaceutical packaging and the need for Sustainable Pharmaceutical Packaging materials. In addition, we have provided information on various regulatory frameworks required in the pharmaceutical packaging industry, along with the benefits and limitations of using sustainable / biodegradable packaging materials for pharmaceutical products.

Pharmaceutical Packaging

Pharmaceutical packaging materials such as vials, blisters, stoppers, cartridges and many more, which are required for filling, sealing, packaging and labelling of the drugs. The primary requisite of pharmaceutical packaging is that these should be user friendly, inert and compatible with the different dosage forms. In order to achieve this, the pharmaceutical packaging processes go through various checkpoints and regulatory guidelines at each step.[5], [6], [7]

Figure 1 presents the steps followed for pharmaceutical aseptic packaging process. [8]

Figure 1 **Steps Involved in Pharmaceutical Aseptic Packaging**



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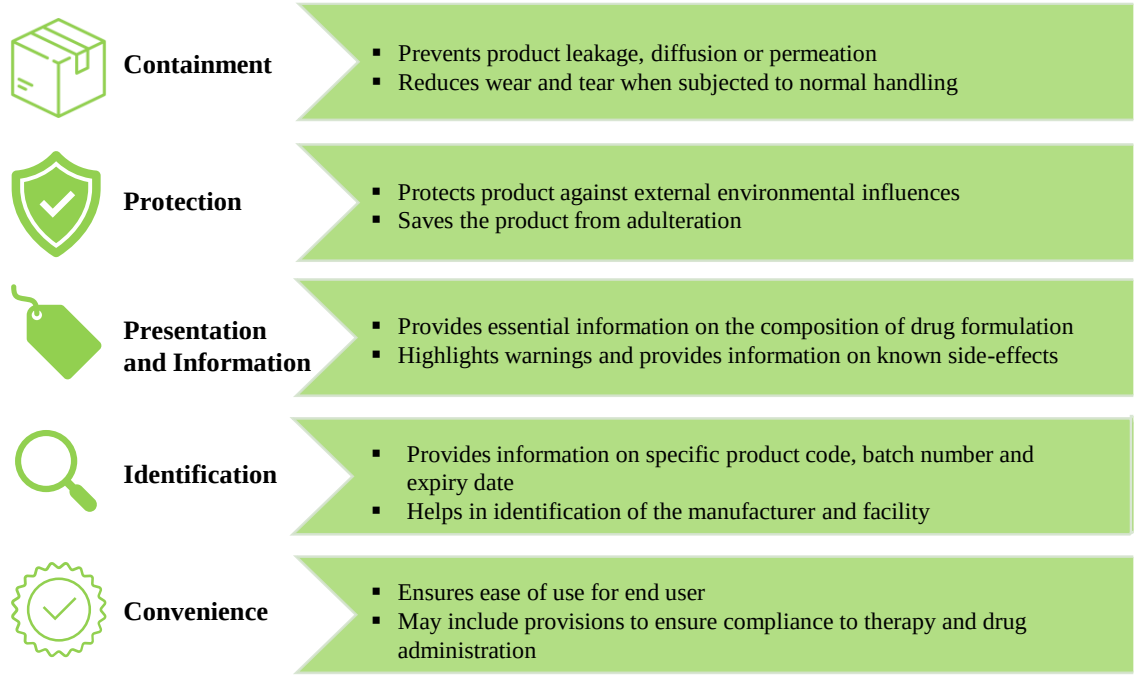
Steps involved in the pharmaceutical aseptic packaging process include:

- **Container Production:** It includes the production of containers such as bottles, syringes, vials, and bags at the manufacturing facility to proceed with the pharmaceutical packaging process.
- **Transportation:** After the successful production of containers, they are transported to another facility where the fill-finishing process takes place.
- **Container Sterilization:** All the containers are sterilized as a fundamental operation to destroy the micro-organisms present in it and prevent the contamination of the product.
- **Aseptic Filling:** It involves filling commercially sterilized products into containers that have been pre-sterilized.
- **Stoppering and Capping:** Post filling all the containers, the drug products are capped and sealed aseptically.
- **Freeze Drying:** It is done for heat-sensitive drugs in order to store them at room temperature for a longer period of time.

Pharmaceutical packaging plays a significant role in shipping sensitive and tightly regulated pharmaceutical products. Figure 2 presents a pictorial summary of the various advantages associated with pharmaceutical packaging. [9]

Figure 2 **Advantages of Pharmaceutical Packaging**



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Types of Pharmaceutical Packaging

There are three categories of packaging: primary, secondary, and tertiary. Figure 3 displays the various types of pharmaceutical packaging. [10]

Figure 3**Types of Pharmaceutical Packaging**

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Additional details on the various types of packaging are outlined below:

- **Primary packaging:** It pertains to the material that is in direct contact with the drug product, which directly affects its shelf life. Majority of the oral solid dosage forms are primarily being packaged in blister packs, sachets and plastic bottles. Further, vials, ampoules and bottles made of plastic or glass are used for primary packaging of liquids (*injectables / orals*). Apart from the aforementioned types of primary packaging, foil packaging, composed of metals such as aluminium and stainless steel, is extensively utilized by medical companies and laboratories to securely transport medical devices and samples.[11]
- **Secondary packaging:** Once the drug is packed in a primary package, another packaging layer is required for its safety, termed as secondary packaging. It consists of printed material (*label*) containing all information about the active and inactive ingredients used in the preparation. Along with this it also presents the information regarding dosage form, dosing schedule, manufacturer's name and address, marketing details of the company, and warning (*if any*). While providing additional protection to the drug product, secondary packaging is also used to ameliorate the attractiveness and brand image of the manufacturer. The most commonly used materials for secondary packing include paper, cardboard and plastic.[12]

- **Tertiary packaging:** When transporting pharmaceuticals in bulk from one location to another, an additional protective layer known as tertiary packaging is essential. Materials for the preparation of tertiary packaging include cardboard, pasteboard and wood.[13]

Need For Sustainable Pharmaceutical Packaging

Globally, only 2% of plastic packaging materials are recycled, while others are either incinerated or dumped into landfills and water bodies. Further, it is important to mention that 30% of the plastic packaging materials are either too complex or too small to recycle; examples include sachets and wrappers resulting in a negative impact on the environment. [14] These packaging materials on the environment are a major concern, hence stirred an alarming need for research in this domain.

Some of the major drawbacks of conventional packaging materials include dependency on fossil fuels, its single-use nature, its inability to biodegrade, chemical leaching and negative public perception. Figure 4 represents the pictorial representation of these drawbacks. [15]

Figure.4 **Drawbacks of Conventional Pharmaceutical Packaging Materials**

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Sustainable Pharmaceutical Packaging Solutions

Sustainability word originated from the Latin word *sustinere*, which means to hold or support. Sustainable packaging is packaging that is safe for both individuals and the environment, while meeting the cost and manufacturing efficiency. Over time, to reduce the impact on environment, many companies and individuals are shifting towards sustainable materials for packaging. In fact, researchers are actively involved in designing novel bio-based raw materials, in order to achieve the desired strength and integrity, along with maintaining the sustainability of the product. In addition, these raw materials are harvested in a way to reduce the consumption of natural resources. Several monomaterials, such as paper, plastic, glass, fabric or metal are also being used in production processes to facilitate the separation of components while recycling.[16], [17]

Moreover, pharmaceutical companies are increasingly focusing on streamlining various packaging operations, which can contribute to reduced raw material and energy consumption. Various steps are being taken to streamline the packaging to make it more sustainable, for instance in the blister packs,

the amount of heat applied is reduced in order to conserve energy and water consumption. Furthermore, companies are continuously tracking the supply chain to optimize manufacturing output and product distribution, thereby minimizing overproduction. As a result, there will be a reduction in energy consumption associated with storing and transporting excess goods.[18]

Figure 5 presents information on the raw materials used in various types of packaging. [19]

Figure 5 **Raw Materials for Packaging**

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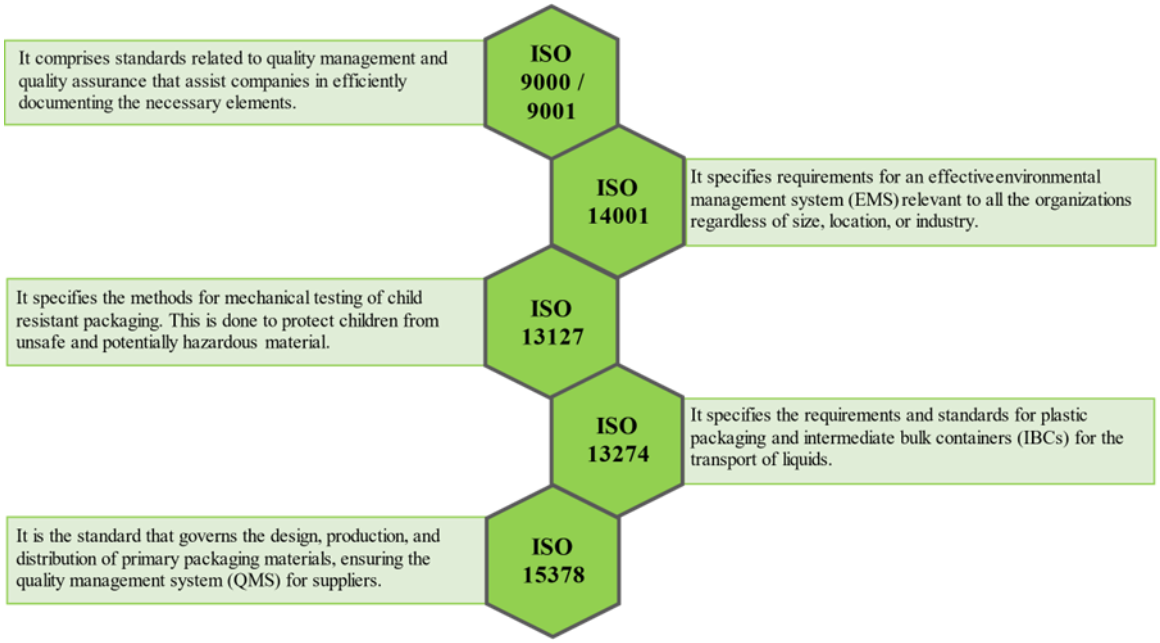
Regulatory Framework

Pharmaceutical industry is one of the highly regulated industries in the world, with stringent controls across each step of development and production, to maintain quality standards and to ensure safety and effectiveness of pharmaceutical products to the patients. Use of natural or plant-based materials as primary packaging is often associated with the potential risk of its interactions with the drug product, which can lead to serious health issues. To avoid such instances, various guidelines have been issued by regulatory authorities. The first and most common is the guideline for good manufacturing practices (GMP), which ensures the proper manufacturing, maintenance, labeling and storage of products. Further, international organization for standardization (ISO) has been established to enforce safe packaging and storage of pharmaceutical agents.[20]

Figure 6 presents the information on various ISO standards related to pharmaceutical packaging.[21]

Figure 6 ISO Standards for Pharmaceutical Packaging



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Advantages of Sustainable Pharmaceutical Packaging Materials

Sustainable Pharmaceutical Packaging materials have a wide array of advantages primarily due to their ability to decompose naturally in the environment and reduce the consumption of resources. Figure 7 presents some advantages associated with Sustainable Pharmaceutical Packaging materials in the pharmaceutical industry.[22], [23]

Figure 7Advantages of Sustainable Pharmaceutical Packaging Materials

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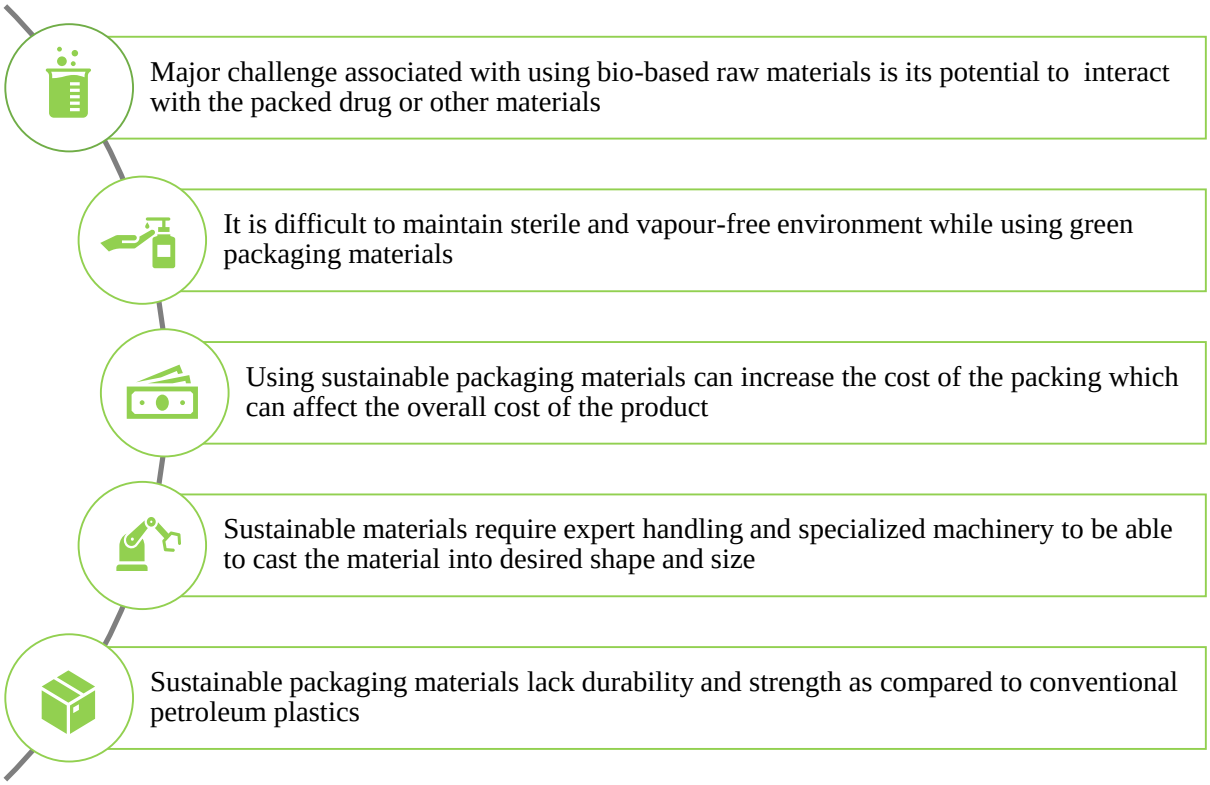
Limitation of Sustainable Pharmaceutical Packaging Materials

Despite the multiple benefits offered by Sustainable Pharmaceutical Packaging, there are certain limitations associated with it. Figure 8 presents the constraints linked to Sustainable Pharmaceutical Packaging materials in the pharmaceutical industry.[24]

Figure 8**Limitations of Sustainable Pharmaceutical Packaging Materials**



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Future Perspectives

In recent years, the pharmaceutical industry has witnessed significant developments related to biodegradable / recyclable materials (*potential alternatives to plastics*); some of these are being widely used for packaging purposes. One such material is plastic made from sugarcane, which is biodegradable in nature.[25] This product has shown promising results, in terms of strength and majority of its properties, such as non-reactivity and robustness, as compared to traditional petroleum plastic. Further, other plastic alternatives, such as polylactic acid obtained from corn starch, sugarcane, and cassava, can serve as excellent materials for sustainable pharmaceutical packaging.

These novel sustainable pharmaceutical packaging materials hold a promise to eliminate the unprecedented issue of environmental degradation in the pharmaceutical industry. This will eventually lead to a sustainable future not only in the pharmaceutical domain but many other industries. Further, we believe that with increasing awareness related to the benefits of Sustainable Pharmaceutical Packaging, this market segment is expected to witness increased adoption in the upcoming years.

CHAPTER 2

MARKET LANDSCAPE

Chapter Overview

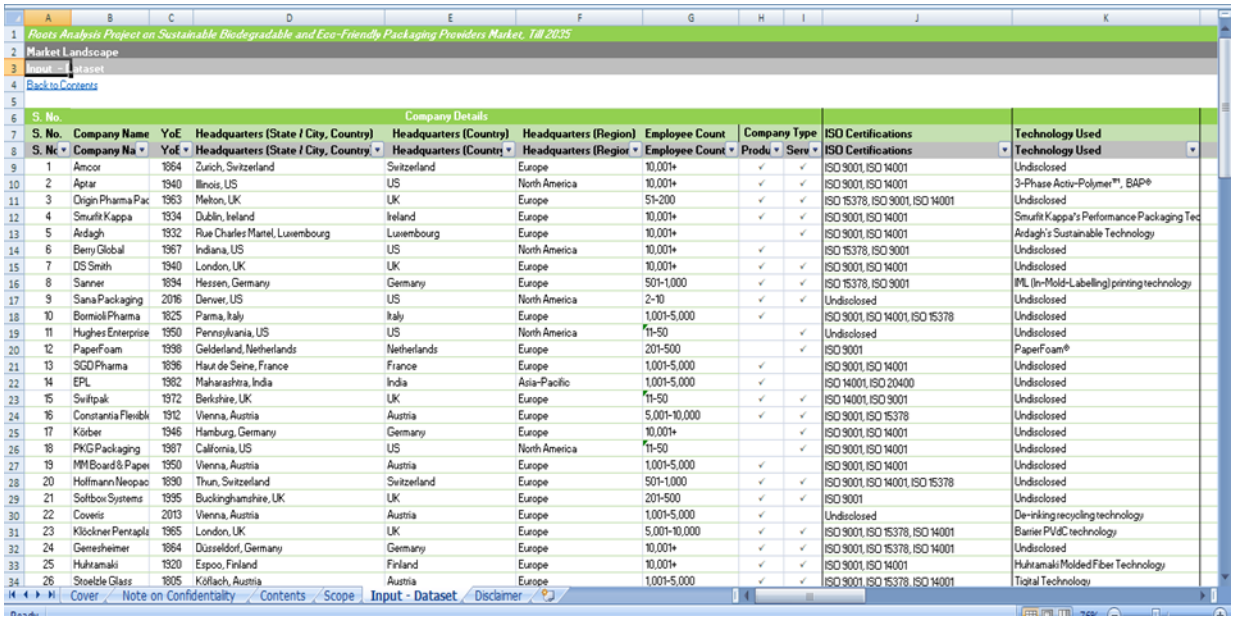
Comprehensive research is conducted to create a database that includes various parameters are decided to capture information for various sustainable packaging providers and their respective products. The database developed within this project includes close to 122 companies providing multiple Sustainable Pharmaceutical Packaging products / services along with parameters like:

- Provider's Year of establishment
- Location of headquarters
- Number of employees
- Company size
- Type of offerings (Products, Services)
- ISO Certifications
- Type of Eco-friendly Packaging (*Reusable, Biodegradable, Recyclable*)
- Origin of Packaging Material (*Natural, Synthetic*)
- Type of Packaging Material Used
- Type of Packaging (*Primary, Secondary, Tertiary*)
- Type of Packaging Containers
- Packaging Applications (*storage containers, pharmaceutical laminates, closures, drug delivery devices, surgical devices, eutectic plates, cooling bags and dosage cups*)

Sustainable Packaging Providers: Database

The database created for companies offering sustainable pharmaceutical packaging products / services is curated by extensive primary and secondary market research through various available sources. Figure 9 and 10 provides a preview of the database and analysis conducted using several parameters.

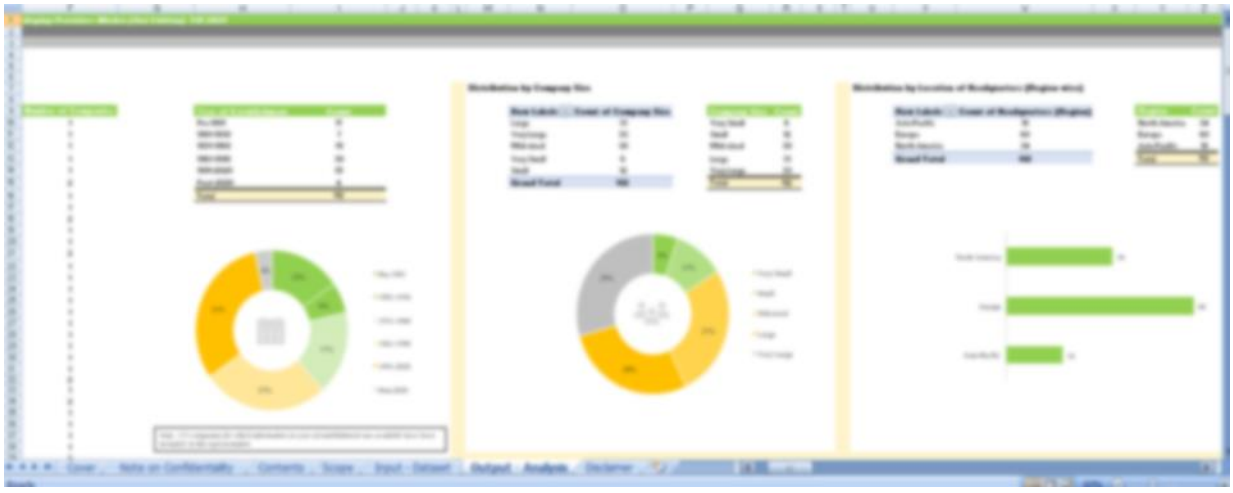
Figure 9 **Sustainable Packaging Providers Database Glimpse**



S. No.	Company Name	YoE	Headquarters (State / City, Country)	Headquarters (Country)	Headquarters (Region)	Employee Count	Company Type		ISO Certifications	Technology Used
							Produ	Serv		
1	Amcor	1864	Zurich, Switzerland	Switzerland	Europe	10,001+	✓	✓	ISO 9001, ISO 14001	Undisclosed
2	Aptar	1940	Illinois, US	US	North America	10,001+	✓	✓	ISO 9001, ISO 14001	3-Phase Activ-Polymer™, BAP®
3	Origin Pharma Pac	1963	Melton, UK	UK	Europe	51-200	✓	✓	ISO 15378, ISO 9001, ISO 14001	Undisclosed
4	Smurfit Kappa	1934	Dublin, Ireland	Ireland	Europe	10,001+	✓	✓	ISO 9001, ISO 14001	Smurfit Kappa's Performance Packaging Tec
5	Ardagh	1932	Rue Charles Martel, Luxembourg	Luxembourg	Europe	10,001+		✓	ISO 9001, ISO 14001	Ardagh's Sustainable Technology
6	Berry Global	1967	Indiana, US	US	North America	10,001+	✓		ISO 15378, ISO 9001	Undisclosed
7	DS Smith	1940	London, UK	UK	Europe	10,001+	✓	✓	ISO 9001, ISO 14001	Undisclosed
8	Sanner	1894	Hessen, Germany	Germany	Europe	501-1,000	✓	✓	ISO 15378, ISO 9001	IML (In-Mold-Labelling) printing technology
9	Sana Packaging	2016	Denver, US	US	North America	2-10	✓	✓	Undisclosed	Undisclosed
10	Bormioli Pharma	1825	Parma, Italy	Italy	Europe	1,001-5,000	✓		ISO 9001, ISO 14001, ISO 15378	Undisclosed
11	Hughes Enterprise	1950	Pennsylvania, US	US	North America	11-50		✓	Undisclosed	Undisclosed
12	PaperFoam	1998	Gelderland, Netherlands	Netherlands	Europe	201-500		✓	ISO 9001	PaperFoam®
13	SGD Pharma	1896	Haut de Seine, France	France	Europe	1,001-5,000	✓		ISO 9001, ISO 14001	Undisclosed
14	EPL	1982	Maharashtra, India	India	Asia-Pacific	1,001-5,000	✓		ISO 14001, ISO 20400	Undisclosed
15	Swiftpak	1972	Berkshire, UK	UK	Europe	11-50	✓	✓	ISO 14001, ISO 9001	Undisclosed
16	Constantia Flexibl	1912	Vienna, Austria	Austria	Europe	5,001-10,000	✓	✓	ISO 9001, ISO 15378	Undisclosed
17	Körber	1946	Hamburg, Germany	Germany	Europe	10,001+		✓	ISO 9001, ISO 14001	Undisclosed
18	PKG Packaging	1987	California, US	US	North America	11-50		✓	ISO 9001, ISO 14001	Undisclosed
19	MM Board & Paper	1950	Vienna, Austria	Austria	Europe	1,001-5,000	✓		ISO 9001, ISO 14001	Undisclosed
20	Hoffmann Neopac	1890	Thun, Switzerland	Switzerland	Europe	501-1,000	✓	✓	ISO 9001, ISO 14001, ISO 15378	Undisclosed
21	Softbox Systems	1995	Buckinghamshire, UK	UK	Europe	201-500	✓	✓	ISO 9001	Undisclosed
22	Coveris	2013	Vienna, Austria	Austria	Europe	1,001-5,000	✓		Undisclosed	De-inking recycling technology
23	Klöckner Pentapla	1965	London, UK	UK	Europe	5,001-10,000	✓	✓	ISO 9001, ISO 15378, ISO 14001	Barrier PVdC technology
24	Gerresheimer	1864	Düsseldorf, Germany	Germany	Europe	10,001+	✓	✓	ISO 9001, ISO 15378, ISO 14001	Undisclosed
25	Huhtamaki	1920	Espoo, Finland	Finland	Europe	10,001+	✓	✓	ISO 9001, ISO 14001	Huhtamaki Molded Fiber Technology
26	Stoelzle Glass	1805	Köflach, Austria	Austria	Europe	1,001-5,000	✓	✓	ISO 9001, ISO 15378, ISO 14001	Digital Technology

Source: Roots Analysis

Figure 10 **Sustainable Packaging Providers Analysis Glimpse**



Source: Roots Analysis

Information including additional sustainable packaging providers has been incorporated into the project report which cannot be disclosed due to confidentiality reasons.

CHAPTER 3

SAMPLE COMPANY PROFILES

Chapter Overview

The chapter presents profiles of prominent players (*shortlisted based on company size of more than 1,000 employees, offering products or services based on all the four types of eco-friendly packaging (reusable, biodegradable, reducible and recyclable)*) engaged in offering services or products for sustainable, biodegradable and eco-friendly packaging for the healthcare sector. Each profile includes the following sections:

- **Company Overview:** This section provides a brief company overview, including details such as its year of establishment, headquarters location, employee count, company type, and leadership team.
- **Financial Information (*if available*):** This section includes information on the financial revenues of the company.
- **Sustainable Pharmaceutical Packaging Offerings:** This section includes detailed information on various products / services offered by the company related to sustainable, biodegradable and eco-friendly packaging (*based on the company website and / or other publicly available information*).

Recent Developments and Future Outlook: This section provides information on the initiatives / recent developments related to sustainable, biodegradable and eco-friendly packaging and strategies that, we believe, (*based on the latest press releases by the company and / or other publicly available information*) the company may adopt in order to drive its growth, in the coming future.

Table 1 lists the companies (organized alphabetically) highlighted in this chapter.

Table 1 **Sustainable Packaging Providers: List of Companies Profiled**

S. No.	Company	YoE	LoH (State / City, Country)	LoH (Region)
1	Company A	1963	Pennsylvania, US	North America
2	XX	Sample Text	Sample Text	Sample Text
3	XX	Sample Text	Sample Text	Sample Text
4	XX	Sample Text	Sample Text	Sample Text
5	XX	Sample Text	Sample Text	Sample Text
6	XX	Sample Text	Sample Text	Sample Text
7	Syntegon	1969	Waiblingen, Germany	Europe

Abbreviation: YoE: Year of Establishment, LoH: Location of Headquarters

Source: Roots Analysis

COMPANY A

Company Overview

Company A is a UK-based company that is engaged in providing innovative packaging solutions, paper-based products as well as recycling services across the world. The company is dedicated towards sustainability and incorporating a circular economy through its various supply chains. Further, it is worth highlighting that the company is partnering with other eminent players with an intent to reduce complexity involved in Sustainable Pharmaceutical Packaging and minimize the environmental impact.

Table 2 presents the overview of Company A.

Table 2 **Company A: Overview**

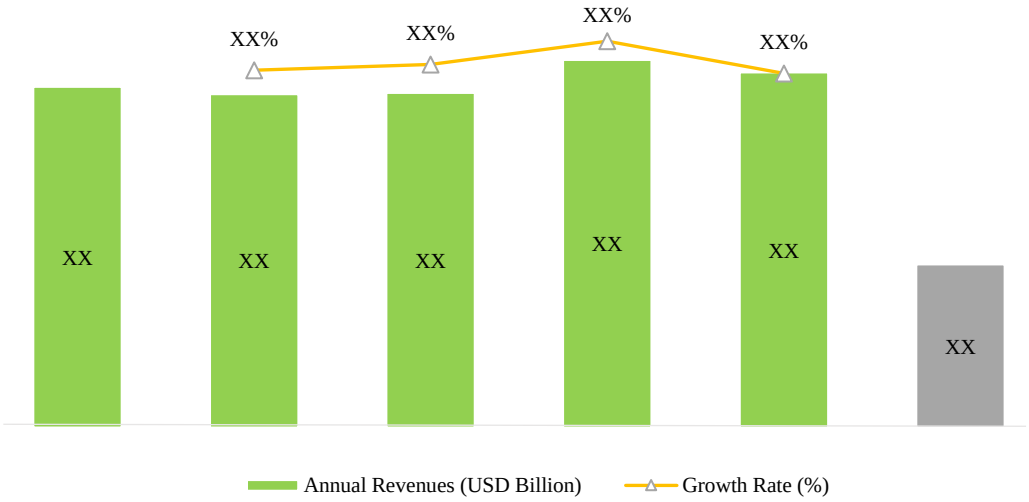
Key Parameters	Description
Year of Establishment	XX
Headquarters	XX
Number of Employees	XX
Leadership Team	XX

Source: Roots Analysis

Financial Information

Figure 12 showcases the company's revenue for the period spanning from FY 2019 to the first half of FY 2024.

Figure 12 **Company A: Annual Revenues, FY2019 – H1 FY2024(GBP Million)**



Source: Roots Analysis

Sustainable Pharmaceutical Packaging Offerings

Table 3 provides information on the Sustainable Pharmaceutical Packaging offerings of Company A.

Table 3 **Company A: Sustainable Pharmaceutical Packaging Offerings**

Key Parameters	Sustainable Pharmaceutical Packaging Offerings
Type of Eco-friendly Packaging	▪ XX ▪ XX
Origin of Packaging Material	▪ XX ▪ XX ▪ XX ▪ XX ▪ XX ▪ XX
Packaging Material Used	XX
Packaging Applications	▪ XX ▪ XX ▪ XX

Source: Roots Analysis

Recent Developments and Future Outlook

Table 4 outlines the recent developments and strategies that we anticipate Company A will implement to stimulate future growth.

Table 4 Company A: Recent Developments and Future Outlook

Strategic Initiatives		Recent / Past Trends	Future Outlook
	Attending conferences and other events to increase company visibility	**August 2023** Sample Text **March 2022** Sample Text **January 2022** Sample Text	Sample Text
	Appointing key personnel to strengthen the Management Team	**September 2023** Sample Text **February 2023** Sample Text **August 2022** Sample Text **February 2022** Sample Text	Sample Text
	Entering into Strategic Collaborations	**October 2022** Sample Text **September 2022** Same Text **August 2022** Sample Text	Sample Text

Strategic Initiatives	Recent / Past Trends	Future Outlook
	January 2022 Sample Text	

Source: Roots Analysis

Comprehensive profiles of additional sustainable packaging providers are featured in the project report but cannot be disclosed for confidentiality reasons.

CHAPTER 4

PARTNERSHIPS AND COLLABORATIONS

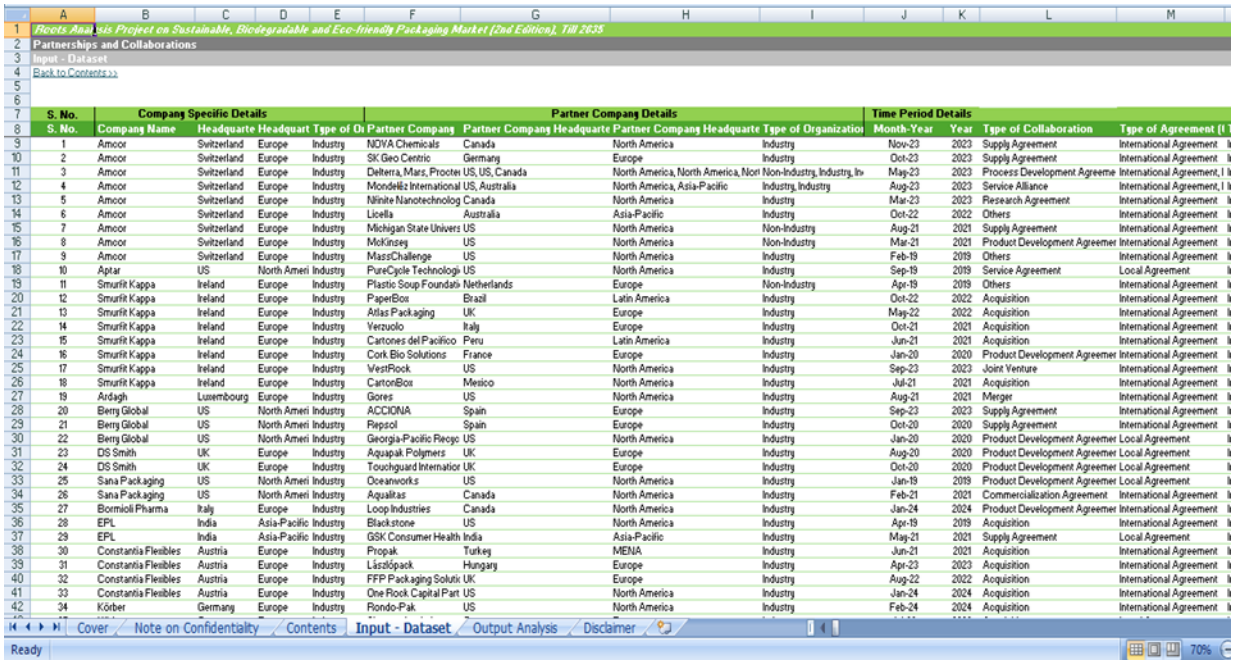
Chapter Overview

We came across several sustainable packaging providers during our research, that have entered into various partnerships with different stakeholders in the industry to expand their product / service portfolios, gain additional capabilities and more visibility in this domain. This chapter provides an overview of the partnering activity reported in this domain, during the period 2019-2024 (*till February*). Additionally, this chapter offers information on various partnership models that have been utilized by the industry players in recent years. The partnership instances captured during our research were analyzed across several parameters, such as partnership year, partnership type, type of partner and type of eco-friendly packaging. Additionally, we have identified the most active players within the domain (*in terms of number of partnerships signed*) along with geographical distribution of the partnership activity.

Partnerships and Collaborations: Input Database

Figure 13 and 14 provides the collated data and analysis of various partnerships inked between the stakeholders engaged in this domain.

Figure 13 **Partnerships and Collaborations Database Glimpse**



S. No.	Company Specific Details				Partner Company Details				Time Period Details			
S. No.	Company Name	Headquarte	Headquart	Type of Or	Partner Company	Partner Company	Headquarte	Partner Company	Headquarte	Type of Organizatio	Month-Year	Year	Type of Collaboration	Type of Agreement (I
1	Amcor	Switzerland	Europe	Industry	NOVA Chemicals	Canada	North America	Industry			Nov-23	2023	Supply Agreement	International Agreement
2	Amcor	Switzerland	Europe	Industry	SK Geo Centric	Germany	Europe	Industry			Oct-23	2023	Supply Agreement	International Agreement
3	Amcor	Switzerland	Europe	Industry	Delterra, Mars, Procter	US, US, Canada	North America, North America, Nort	Non-Industry, Industry, In			May-23	2023	Process Development Agreeme	International Agreement, I
4	Amcor	Switzerland	Europe	Industry	Mondelēz International	US, Australia	North America, Asia-Pacific	Industry, Industry			Aug-23	2023	Service Alliance	International Agreement, I
5	Amcor	Switzerland	Europe	Industry	Nfinite Nanotechnolog	Canada	North America	Industry			Mar-23	2023	Research Agreement	International Agreement
6	Amcor	Switzerland	Europe	Industry	Licella	Australia	Asia-Pacific	Industry			Oct-22	2022	Others	International Agreement
7	Amcor	Switzerland	Europe	Industry	Michigan State Univers	US	North America	Non-Industry			Aug-21	2021	Supply Agreement	International Agreement
8	Amcor	Switzerland	Europe	Industry	McKinsey	US	North America	Non-Industry			Mar-21	2021	Product Development Agreemer	International Agreement
9	Amcor	Switzerland	Europe	Industry	MassChallenge	US	North America	Industry			Feb-19	2019	Others	International Agreement
10	Aptar	US	North Ameri	Industry	PureCycle Technologi	US	North America	Industry			Sep-19	2019	Service Agreement	Local Agreement
11	Smurfit Kappa	Ireland	Europe	Industry	Plastic Soup Foundati	Netherlands	Europe	Non-Industry			Apr-19	2019	Others	International Agreement
12	Smurfit Kappa	Ireland	Europe	Industry	PaperBox	Brazil	Latin America	Industry			Oct-22	2022	Acquisition	International Agreement
13	Smurfit Kappa	Ireland	Europe	Industry	Atlas Packaging	UK	Europe	Industry			May-22	2022	Acquisition	International Agreement
14	Smurfit Kappa	Ireland	Europe	Industry	Verzuolo	Italy	Europe	Industry			Oct-21	2021	Acquisition	International Agreement
15	Smurfit Kappa	Ireland	Europe	Industry	Cartones del Pacifico	Peru	Latin America	Industry			Jun-21	2021	Acquisition	International Agreement
16	Smurfit Kappa	Ireland	Europe	Industry	Cork Bio Solutions	France	Europe	Industry			Jan-20	2020	Product Development Agreemer	International Agreement
17	Smurfit Kappa	Ireland	Europe	Industry	WestRock	US	North America	Industry			Sep-23	2023	Joint Venture	International Agreement
18	Smurfit Kappa	Ireland	Europe	Industry	CartonBox	Mexico	North America	Industry			Jul-21	2021	Acquisition	International Agreement
19	Ardagh	Luxembourg	Europe	Industry	Gores	US	North America	Industry			Aug-21	2021	Merger	International Agreement
20	Berry Global	US	North Ameri	Industry	ACCIONA	Spain	Europe	Industry			Sep-23	2023	Supply Agreement	International Agreement
21	Berry Global	US	North Ameri	Industry	Repsol	Spain	Europe	Industry			Oct-20	2020	Supply Agreement	International Agreement
22	Berry Global	US	North Ameri	Industry	Georgia-Pacific Recyc	US	North America	Industry			Jan-20	2020	Product Development Agreemer	Local Agreement
23	DS Smith	UK	Europe	Industry	Aquapak Polymers	UK	Europe	Industry			Aug-20	2020	Product Development Agreemer	Local Agreement
24	DS Smith	UK	Europe	Industry	Touchguard Internatior	UK	Europe	Industry			Oct-20	2020	Product Development Agreemer	Local Agreement
25	Sana Packaging	US	North Ameri	Industry	Oceanworks	US	North America	Industry			Jan-19	2019	Product Development Agreemer	Local Agreement
26	Sana Packaging	US	North Ameri	Industry	Aqualitas	Canada	North America	Industry			Feb-21	2021	Commercialization Agreement	International Agreement
27	Bormioli Pharma	Italy	Europe	Industry	Loop Industries	Canada	North America	Industry			Jan-24	2024	Product Development Agreemer	International Agreement
28	EPL	India	Asia-Pacific	Industry	Blackstone	US	North America	Industry			Apr-19	2019	Acquisition	International Agreement
29	EPL	India	Asia-Pacific	Industry	GSK Consumer Health	India	Asia-Pacific	Industry			May-21	2021	Supply Agreement	Local Agreement
30	Constantia Flexibles	Austria	Europe	Industry	Propak	Turkey	MENA	Industry			Jun-21	2021	Acquisition	International Agreement
31	Constantia Flexibles	Austria	Europe	Industry	Lászlópack	Hungary	Europe	Industry			Apr-23	2023	Acquisition	International Agreement
32	Constantia Flexibles	Austria	Europe	Industry	FFP Packaging Solutic	UK	Europe	Industry			Aug-22	2022	Acquisition	International Agreement
33	Constantia Flexibles	Austria	Europe	Industry	One Rock Capital Part	US	North America	Industry			Jan-24	2024	Acquisition	International Agreement
34	Körber	Germany	Europe	Industry	Rondo-Pak	US	North America	Industry			Feb-24	2024	Acquisition	International Agreement

Source: Roots Analysis

Figure 14 **Partnerships and Collaborations Analysis Glimpse**

Source: Roots Analysis

The project report contains a thorough analysis of all the partnerships and collaborations, which cannot be revealed due to confidentiality reasons.

CHAPTER 5

FUNDING AND INVESTMENTS

Chapter Overview

Over time, financial support from angel investors, venture capitalists, public and private funding programs, and regulatory bodies has enabled Sustainable packaging providers to strengthen their research and development activities in the Sustainable Pharmaceutical Packaging sector. This chapter examines the capital investments made in companies involved in developing Sustainable Pharmaceutical Packaging products and services, providing an overview of the evolution of investment activity in the overall market. Further, this chapter provides details on funding instances (*in reverse chronological order*) reported by companies providing Sustainable Pharmaceutical Packaging services / products, along with the information on their year of establishment, location of headquarters, company size, type of funding, month and year of funding, amount invested (USD million) and lead investors (*wherever applicable*).

It is important to mention that the information presented in the chapter is completely factual and should not be misconstrued as a recommendation regarding any of the companies / products mentioned within. The funding instances presented in the following sections were identified from company websites, press releases and other publicly available databases.

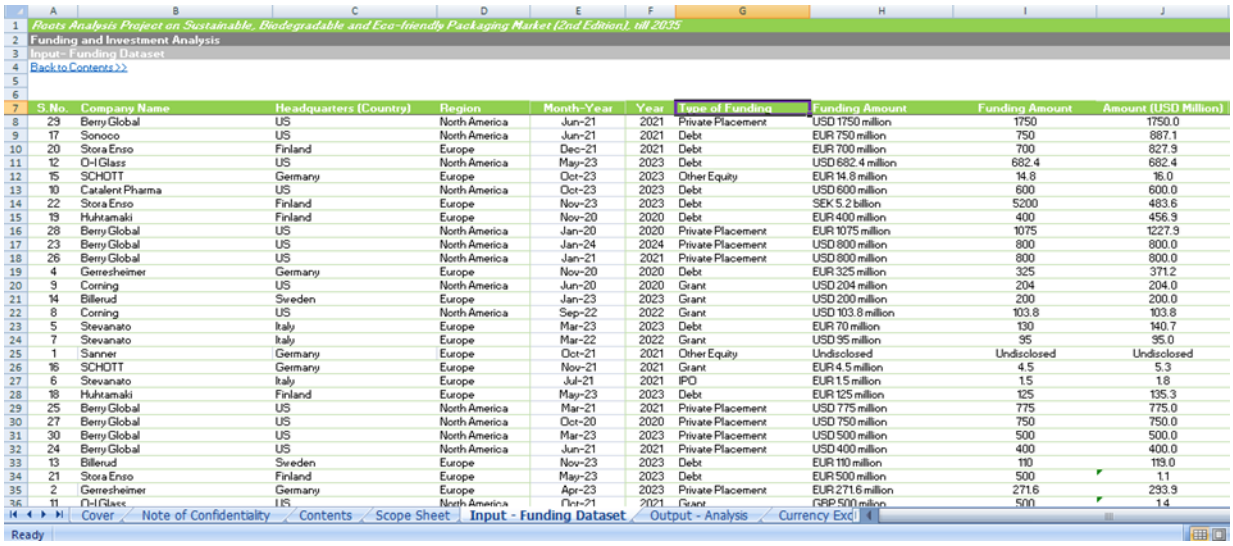
Funding Models

For the purpose of this analysis, we have examined various methods through which a company may secure financing. These include:

- **Debt Financing:** In debt financing, a company secures financing from a or an investor through venture debt and is obligated to repay the principal amount along with interest, regardless of its profitability.
- **Grant / Award:** Grants and awards are provided by government and non-government agencies like the National Institutes of Health and the Bill and Melinda Gates Foundation. Although grants typically involve smaller amounts compared to other funding sources, they support early-stage research efforts for small companies.
- **Private Placement:** Private placement involves raising capital by selling shares to individual or group investors, such as high net worth individuals and venture capital firms.

- **Initial Public Offering (IPO):** An IPO occurs when a private company offers its shares to the public for the first time to raise funds for product development and to provide returns to early-stage investors. A successful IPO marks a company's transition to being publicly traded.
- **Other Equity:** This category encompasses various forms of equity investments not classified under the previously mentioned types, as identified during our research.

Figure 15 **Funding and Investments Database Glimpse**



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S. No.	Company Name	Headquarters (Country)	Region	Month-Year	Year	Type of Funding	Funding Amount	Funding Amount	Amount (USD Million)
29	Berry Global	US	North America	Jun-21	2021	Private Placement	USD 1750 million	1750	1750.0
17	Sonoco	US	North America	Jun-21	2021	Debt	EUR 750 million	750	887.1
20	Stora Enso	Finland	Europe	Dec-21	2021	Debt	EUR 700 million	700	827.9
12	O-I Glass	US	North America	May-23	2023	Debt	USD 682.4 million	682.4	682.4
15	SCHOTT	Germany	Europe	Oct-23	2023	Other Equity	EUR 14.8 million	14.8	16.0
10	Catalent Pharma	US	North America	Oct-23	2023	Debt	USD 600 million	600	600.0
22	Stora Enso	Finland	Europe	Nov-23	2023	Debt	SEK 5.2 billion	5200	483.6
19	Huhtamaki	Finland	Europe	Nov-20	2020	Debt	EUR 400 million	400	456.9
28	Berry Global	US	North America	Jan-20	2020	Private Placement	EUR 1075 million	1075	1227.9
23	Berry Global	US	North America	Jan-24	2024	Private Placement	USD 800 million	800	800.0
26	Berry Global	US	North America	Jan-21	2021	Private Placement	USD 800 million	800	800.0
4	Gerresheimer	Germany	Europe	Nov-20	2020	Debt	EUR 325 million	325	371.2
9	Corning	US	North America	Jun-20	2020	Grant	USD 204 million	204	204.0
14	Billerud	Sweden	Europe	Jan-23	2023	Grant	USD 200 million	200	200.0
8	Corning	US	North America	Sep-22	2022	Grant	USD 103.8 million	103.8	103.8
5	Stevanato	Italy	Europe	Mar-23	2023	Debt	EUR 70 million	130	140.7
7	Stevanato	Italy	Europe	Mar-22	2022	Grant	USD 95 million	95	95.0
1	Sanner	Germany	Europe	Oct-21	2021	Other Equity	Undisclosed	Undisclosed	Undisclosed
16	SCHOTT	Germany	Europe	Nov-21	2021	Grant	EUR 4.5 million	4.5	5.3
6	Stevanato	Italy	Europe	Jul-21	2021	IPO	EUR 1.5 million	1.5	1.8
18	Huhtamaki	Finland	Europe	May-23	2023	Debt	EUR 125 million	125	135.3
25	Berry Global	US	North America	Mar-21	2021	Private Placement	USD 775 million	775	775.0
27	Berry Global	US	North America	Oct-20	2020	Private Placement	USD 750 million	750	750.0
30	Berry Global	US	North America	Mar-23	2023	Private Placement	USD 500 million	500	500.0
24	Berry Global	US	North America	Jun-21	2021	Private Placement	USD 400 million	400	400.0
13	Billerud	Sweden	Europe	Nov-23	2023	Debt	EUR 110 million	110	119.0
21	Stora Enso	Finland	Europe	May-23	2023	Debt	EUR 500 million	500	1.1
2	Gerresheimer	Germany	Europe	Apr-23	2023	Private Placement	EUR 271.6 million	271.6	293.9
11	O-I Glass	US	North America	Oct-21	2021	Grant	GBP 500 million	500	1.4

Cover | Note of Confidentiality | Contents | Scope Sheet | Input - Funding Dataset | Output - Analysis | Currency Exc
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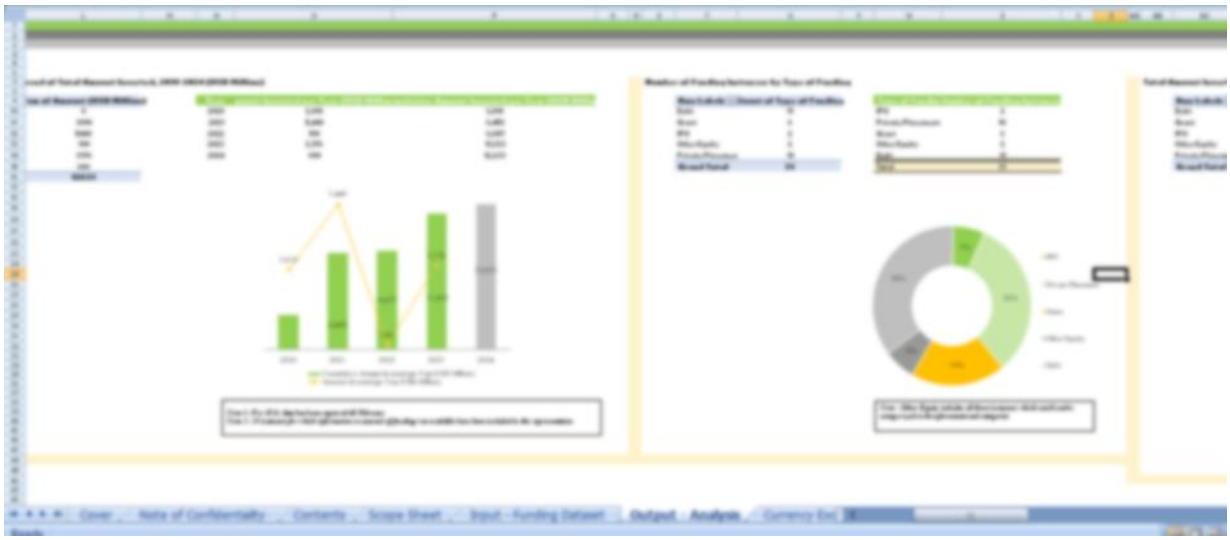
Figure 16 **Funding and Investments Analysis Glimpse**



The project report contains a comprehensive examination of 31 funding cases related to sustainable pharmaceutical packaging. However, this information cannot be disclosed due to confidentiality reasons.

CHAPTER 6

INTERVIEW CONTACT LIST

During the course of the project, I prepared an interview contact list for conducting primary research. A database containing the contact details of relevant people in the particular firm was prepared. The collected data was used for conducting interviews with important stakeholders in this domain. Additionally, we run surveys using these contacts.

Primary research conducted using this information helps us in drawing important insights from the market directly. An example of one such interview contact list has been presented in the table below.

Table 5 **Sustainable Packaging Providers: Sample Interview Contact List of Companies**

S. No	Company	Name	Designation	Email
1	Amcor	Ron Delia	Chief Executive Officer	ron.delia@amcor.com
2	Aptar	Stephan Tanda	Chief Executive Officer	stephan.tanda@aptar.com
3	Ardagh Group	Matthew Aston	Director	matthew.aston@ardaghgroup.com
4	Ardagh Group	Paul Coulson	CEO	paul.coulson@ardaghgroup.com
5	Berlin Packaging	Rick Brandt	Chief Executive Officer	rbrandt@berlinpackaging.com
6	Berry Global	Tom Salmon	Chief Executive Officer	tomsalmon@berryglobal.com
7	Bormioli Pharma	Alessandro Gazzotti	Director	alessandro.gazzotti@bormiolipharma.com
8	Bormioli Pharma	Andrea Lodetti	CEO	andrea.lodetti@bormiolipharma.com
9	Bormioli Pharma	Mauro Gandolfi	Director	mauro.gandolfi@bormiolipharma.com
10	Bormioli Pharma	Valerio Agostini	Director	valerio.agostini@bormiolipharma.com
11	Comar	Michael Ruggieri	Chief Executive Officer	mruggieri@comar.com
12	Constantia Flexibles	PimVervaat	Chief Executive Officer	pim.vervaat@cflex.com
13	Coveris	BERNHARD MUMELTER	Director	bernhard.mumelter@coveris.com
14	Coveris	CHRISTIAN KOLARIK	PRESIDENT	christian.kolarik@coveris.com
15	Coveris	DENNIS PATTERSON	"DENNIS PATTERSON	
16	PRESIDENT LABELS & BOARD"	DENNIS.PATTERSON@coveris.com		
17	Coveris	JAKOB A. MOSSER	CEO	jakob.mosser@coveris.com
18	Coveris	MARTIN DAVIS	PRESIDENT	martin.davis@coveris.com

S. No	Company	Name	Designation	Email
19	Company A	Miles Roberts	Chief Executive Officer	miles.roberts@dssmith.com
20	Ess Dee Aluminium	Sudip Dutta	chairman	sudipdutta@essdee.in
21	Gerresheimer	Dietmar Siemssen	Chief Executive Officer	dietmar.siemssen@gerresheimer.com
22	Hughes Enterprises	Amy Packer	Director	apacker@hughesent.com
23	Hughes Enterprises	Steve Hughes	CEO	shughes@hughesent.com
24	Huhtamaki	Charles Héaulmé	CEO	charles.heaulme@huhtamaki.com
25	Mondi Group	Andrew King	Chief Executive Officer	andrew.king@mondigroup.com
26	Origin Pharma Packaging	Tim Pocock	Chief Executive Officer	tim.pocock@originltd.com
27	Owens Illinois	Arnaud Aujouannet	Senior Vice President	arnaud.aujouannet@o-i.com
28	Owens Illinois	"Andres A. Lopez		
29	"	CEO	Andres.Lopez@o-i.com	
30	PaperFoam	Damon Kuntz	Director	kuntzd@paperfoam.com
31	PaperFoam	Dustin Wills	Founder and Principal	willsd@paperfoam.com
32	PaperFoam	Philip Bredt	Vice President	bredtp@paperfoam.com
33	PaperFoam	Roel Groenveld	General Manager	groenveldr@paperfoam.com
34	PaperFoam	Willem Derkman	Chief Executive Officer	derkmanw@paperfoam.com
35	PGP Glass	Mohammedfiroj Shaikh	Assistant General Manager	mohammedfiroj.shaikh@piramalglass.com
36	PGP Glass	Vijay Shah	CEO	vijay.shah@piramalglass.com
37	Pharmapac	Linda McEnaney	Director	lindamcenaney@pharmapacuk.com
38	PKG Packaging	Craig Swett	VP Sales	c.swett@pkgpackaging.com
39	PKG Packaging	Frank Roughan	Executive Vice President	f.roughan@pkgpackaging.com
40	ProAmpac.	Brent Wise	Vice President	brent.wise@proampac.com
41	ProAmpac.	Eric Daughtry	Vice President	eric.daughtry@proampac.com
42	ProAmpac.	Greg Tucker	Founder and CEO	greg.tucker@proampac.com
43	ProAmpac.	Kelly Lisk	Chief Executive Officer	kelly.lisk@proampac.com
44	Röchling Group	Raphael A. Wolfram	CEO	rwolfram@roechling.com
45	SANA PACKAGING	Ron Basak-Smith	Chief Executive Officer	ron@sanapackaging.com
46	Schott	Dr. Frank Heinricht	Chief Executive Officer	frank.heinricht@schott.com
47	Sealed Air	Angel Shelton Willis	VP,	angel.willis@sealedair.com
48	Sealed Air	Claudia Contini	Director	claudia.contini@sealedair.com
49	Sealed Air	Emile Chammas	VP	emile.chammas@sealedair.com
50	Sealed Air	Gerd Wichmann	PRESIDENT	gerd.wichmann@sealedair.com
51	Sealed Air	Kevin Piccione	PRESIDENT	kevin.piccione@sealedair.com
52	Sealed Air	Sergio Pupkin	VP	sergio.pupkin@sealedair.com

S. No	Company	Name	Designation	Email
53	Sealed Air	Susan Edwards	VP	susan.edwards@sealedair.com
54	Sealed Air	Ted Doheny	CEO	ted.doheny@sealedair.com
55	Sealed Air	Tobias Grasso	PRESIDENT	tobias.grasso@sealedair.com
56	SGD Pharma	Christophe Nicoli	Chief Executive Officer	christophe.nicoli@sgdgroup.com
57	Softbox Systems	Kevin Valentine	Chief Executive Officer	kevin.valentine@softboxsystems.com
58	Sonoco	R. Howard Coker	Chief Executive Officer	howard.coker@sonoco.com
59	Stoelzle Glass Group	Artur Woloszyn, MBA	CEO	artur.woloszyn@stoelzle.com
60	Stoelzle Glass Group	Ewelina Tokarska	Director	ewelina.tokarska@stoelzle.com
61	Stoelzle Glass Group	Georg Feith	CEO	georg.feith@stoelzle.com
62	Swiftpak	Craig Gulley	Managing Director	craig.gulley@swiftpak.co.uk
63	Tekni-Plex	Brenda Chamulak	Chief Executive Officer	brenda.chamulak@tekni-plex.com

CHAPTER 7

CONCLUSION

This report provides a brief description of the work done during my internship period. It describes how we initially start working on a report and drafting chapters sourced from the captured information in the database. All these chapters are finally combined to build a client ready document. It outlines the steps involved in creating the report, emphasizing secondary research, data analysis and validation, and the chapters. The individual chapters are consolidated to form a unified document, producing a research report ready for clients that undergoes a quality assurance process to guarantee its excellence.

During my internship period, my primary focus was to work at multiple reports at same time and ensure the quality, accuracy, and effectiveness of content produced. Our team is responsible for the reviewing in order to ensure the quality of the report, guarantee accuracy, presentation, and adherence to the company's standards. Additionally, our responsibilities include proofreading, restructuring, and editing the content created by the writers, optimizing content using SEO guidelines, pitching new ideas, and collaborating with project teams on various projects. Further, I have been actively involved in content creation for digital marketing and organizing various events in the firm.

This internship report contains only the information and content that the company has allowed to reveal for the completion of this report. These 6 months of internship period has enabled me to have a basic understanding on how to work and prepare a business research report, along with the roles and responsibilities of a business analyst.

References

1. Knowledgeridge.com. [Online]. Available: https://www.knowledgeridge.com/expert-views/transforming-pharmaceutical-andmedical-device-primary-packaging-forsustainability#:~:text=Pharmaceutical%20And%20Medical%20Device%20Primary%. [Accessed: 06-Jun-2024].
2. I. D. Ibrahim et al., "Need for sustainable packaging: An overview," Polymers (Basel), vol. 14, no. 20, p. 4430, 2022.
3. F. Bassani, C. Rodrigues, and F. Freire, "Life cycle assessment of pharmaceutical packaging addressing end-of-life alternatives," Waste Manag., vol. 175, pp. 1–11, 2024.
4. S. Moore, "Biodegradable and sustainable plastic alternatives in pharmaceutical packaging," AZoM, 01-Feb-2021. [Online]. Available: https://www.azom.com/article.aspx?ArticleID=20060. [Accessed: 06-Jun-2024].
5. S. Mittal, B. Wadhwani, and M. Lakhani, "Innovations in Pharma Packaging Technologies," J. Young Pharm., vol. 13, no. 3, pp. 197–200, 2021.
6. "No title," Blueprintautomation.com. [Online]. Available: https://blueprintautomation.com/en/event/the-importance-of-packaging-in-thepharmaceutical-industry. [Accessed: 06-Jun-2024].
7. "Jul-sep 2023 - volume 7 - issue 3 : Matrix science pharma," Lww.com. [Online]. Available: https://journals.lww.com/mtsp/fulltext/2023/07030/a_step_toward_sustainability__a_r. [Accessed: 06-Jun-2024].
8. Lubrizolcdmo.com. [Online]. Available: https://lubrizolcdmo.com/blog/aseptic-manufacturing-and-sterile-fill-finish-forcomplex-drug-products/. [Accessed: 06-Jun-2024].
9. T. Boomsma, "Pharmaceutical Packaging Types & Benefits (updated 2023)," Swiftpak, 05-Oct-2023.
10. Polypouch.co.uk. [Online]. Available: https://www.polypouch.co.uk/news/pharmaceutical-packaging-types-benefits/. [Accessed: 06-Jun-2024].
11. Meghmaniglobal.com. [Online]. Available: https://www.meghmaniglobal.com/what-are-the-different-types-of-pharmaceuticalpackaging/. [Accessed: 06-Jun-2024].
12. Swiftpak.co.uk. [Online]. Available: https://www.swiftpak.co.uk/insights/pharmaceutical-packaging-types-andbenefits#:~:text=Common%20types%20of%20primary%20pharmaceutical,and%20w. [Accessed: 06-Jun-2024].
13. Ecobliss-pharma.com. [Online]. Available: https://www.ecobliss-pharma.com/blog/pharmaceutical-primary-secondary-tertiarypackaging. [Accessed: 06-Jun-2024].
14. I. D. Ibrahim et al., "Need for sustainable packaging: An overview," Polymers (Basel), vol. 14, no. 20, p. 4430, 2022.

15. “Plastic vs paper packaging: The pros and cons,” Swiftpak. [Online]. Available: https://www.swiftpak.co.uk/insights/plastic-vs-paper-packaging-the-pros-and-cons. [Accessed: 06-Jun-2024].
16. “Sustainable pharmaceutical packaging,” Origin Pharma Packaging, 21-Jun-2018. [Online]. Available: https://www.originltd.com/packaging-design/sustainable-pharmaceutical-packaging/. [Accessed: 06-Jun-2024].
17. Originltd.com. [Online]. Available: https://www.originltd.com/packaging-design/sustainablepharmaceuticalpackaging/#:~:text=Sustainable%20packaging%20is%20designed%20. [Accessed: 06-Jun-2024].
18. News-medical.net. [Online]. Available: https://www.news-medical.net/life-sciences/How-is-Sustainability-Incorporated-intoPharmaceutical-Packaging.aspx. [Accessed: 06-Jun-2024].
19. “Review on: THE PHARMACEUTICAL PACKAGING,” PharmaTutor. [Online]. Available: https://www.pharmatutor.org/articles/the-pharmaceutical-packaging-article. [Accessed: 06-Jun-2024].
20. J. Clifton, “Why ISO standards are important in the packaging industry,” Packaging Strategies, 20-Sep-2019. [Online]. Available: https://www.packagingstrategies.com/articles/95098-why-iso-standards-are-soimportant-in-the-packaging-industry. [Accessed: 06-Jun-2024].
21. “Envoy solutions,” Hughesent.com. [Online]. Available: https://www.hughesent.com/blog/4-advantages-of-eco-friendly-packaging/. [Accessed: 06-Jun-2024].
22. “Discover thousands of collaborative articles on 2500+ skills,” Linkedin.com. [Online]. Available: https://www.linkedin.com/pulse/top-5-benefits-sustainable-packaging-your-businessvic-ning-rperc/. [Accessed: 06-Jun-2024].
23. M. Kaur, “The pros and cons of Eco-friendly packaging,” LeKAC, 19-Nov-2020. [Online]. Available: https://lekac.com/production/the-pros-and-cons-of-eco-friendly-packaging. [Accessed: 06-Jun-2024].
24. Farmersreviewafrica.com. [Online]. Available: https://farmersreviewafrica.com/biodegradable-and-sustainable-packagingalternatives-to-drive-the-sugarcane-packaging-market-to-us-889-0-million-by-2033/. [Accessed: 06-Jun-2024].