

Invest Puerto Rico

Final
Presentation

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EMAP Team:

- Anupama Goyal
- Andras Laszloffy
- Todd Roark
- Jessica Vila-Goulding

Invest Puerto Rico Liaisons:

- John Bozek, Research & Strategy Analyst
- Sam Talman, Business Development Manager

EMAP Advisor:

- Professor Izak Duenyas

EMAP Team

University of Michigan – Stephen Ross School of Business



Jessica Vila-Goulding

Ford Motor Co.

Associate Director

Pension Asset Management



Andras Laszloffy

Dassault Systemes

Director, Engineering

Simulation Software R&D



Anupama Goyal

Michigan Medicine

Director of Hospitalist

Service, Director of

Medical-Surgical Unit



Todd Roark

Henry Ford Health System

Director Advanced

Practice Providers &

Clinical Services

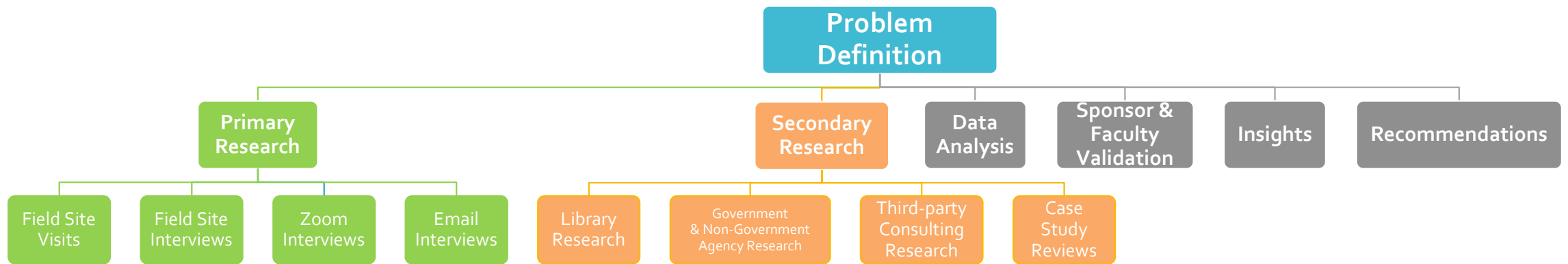
An Analysis of Puerto Rico's Pharmaceutical Temperature-Controlled Logistics Market & Recommendations for Competitiveness



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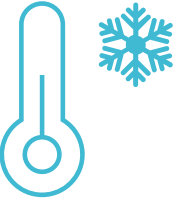
Research Methodology

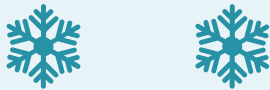




Problem Definition

1. How might pharma temperature-controlled logistics enable Puerto Rico to retain its competitiveness as a top 10 pharma destination?
2. How might Puerto Rico position itself to remain competitive in the long-run?

Pharmaceutical Temperature- Controlled Logistic Temperature Range Categories

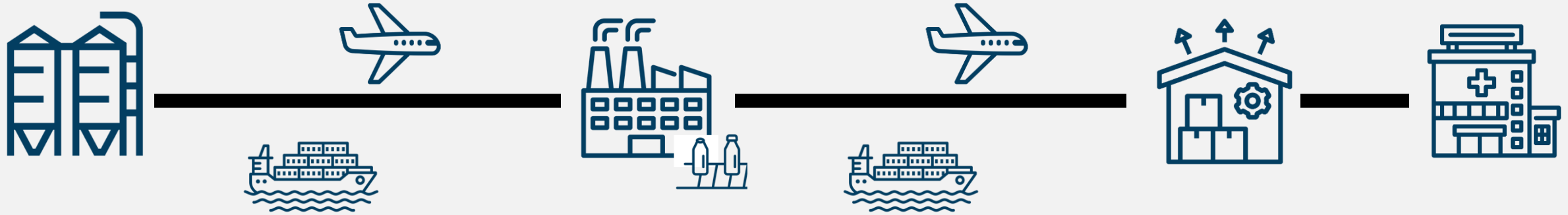


Cold Chain	Controlled Room Temperature	Freezer
2 °C to 8 °C	15 °C to 25 °C	-25 °C to -10 °C
		

The last few years have seen industry terminology shifting from "cold chain" to "temperature-controlled" to account for the growing controlled room temperature market

Source: 2019 Biopharma Cold-Chain Logistic Survey. What matters most and what it means for the future. Pelican Biothermal™

GLOBAL PHARMA (SIMPLIFIED) SUPPLY CHAIN VIEW



Source

Make

Deliver



**Active
Ingredient**

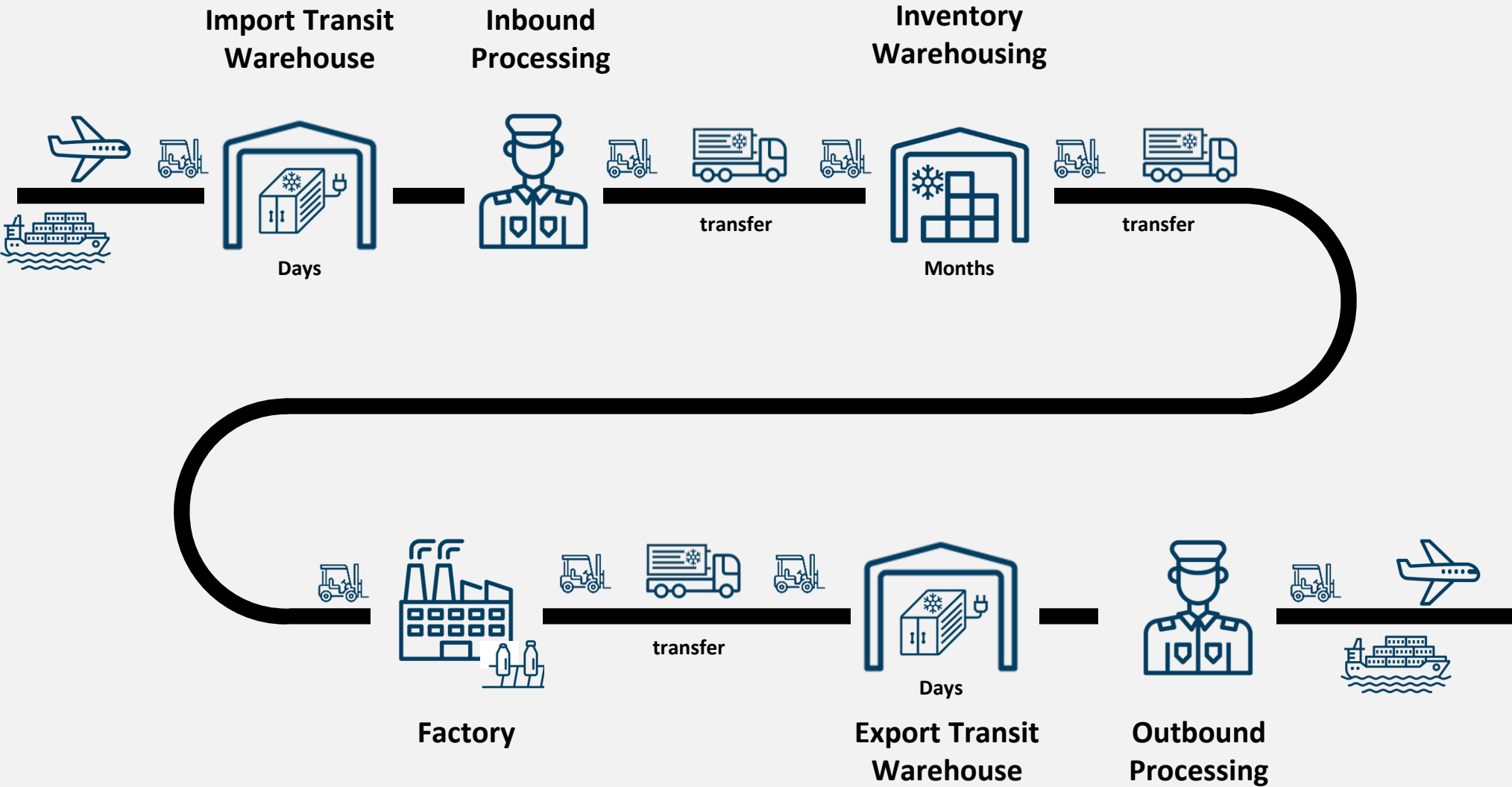


Drug Product



Finished Goods

PUERTO RICO PHARMA SUPPLY CHAIN VIEW



Stakeholder Interviews

Industry
Associations
Alliances

Government
Agencies

University

Pharma
Companies

Logistics / Other



DEPARTAMENTO DE DESARROLLO
ECONÓMICO Y COMERCIO
DDEC



CHALLENGES AS HEARD

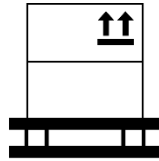
CORE ISSUES

1



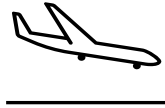
Limited Strategic Warehousing

2



RKN Availability

3



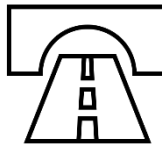
Airport To/From Infrastructure

4



Route Connectivity

5



Poor Road Infrastructure

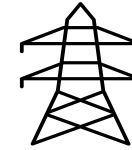
6



Processing Delays, Manual Paperwork

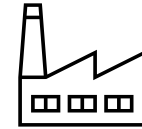
ENABLERS

7



Unreliable and Costly Electricity

8



Limited Large Move-in Ready Facilities

9



Talent Retention

10



Short-Term Vision; Gov't every 4 Years



Insufficient Collaboration

CHALLENGES AS HEARD

CORE ISSUES

1
“We need temperature-controlled warehousing at the airport”

Limited Strategic Warehousing

2
“Cold chain is another challenge, especially getting CRT containers”

RKN Availability

3
“No direct routes for heavy cargo .. up to 3 hours to cross the island via local traffic.”

Airport To/From Infrastructure

4
“In terms of air cargo, there are limited routes in and out of PR”

Route Connectivity

5
“Roads are full of potholes due to weather events like Maria”

Poor Road Infrastructure

6
“This export declaration with domestic shipments is ridiculous. Need less complexity and become more reliable”

Processing Delays, Market Network

ENABLERS

7
“Power issues with frequent outages need generators and then back up of generators”

Unreliable and Costly Electricity

8
“Approximately 20% of the units need repair ... no new buildings are being constructed at present”

Limited Large Move-in Ready Facilities

9
“They will interview students for permanent positions that take our talent out of PR to U.S. mainland.”

Talent Retention

10
“Our capacity on PR is 4 years because the administration changes every 4 years and so do the priorities”

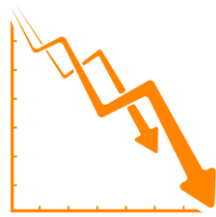
Short-Term Vision; Gov't every 4 years



“Implement and manage best practices on how to manage and store good in a way that it provides consistent result”.... “As an island come together to make the whole better”

Insufficient Collaboration

KEY TAKEAWAYS



Benchmarking of current conditions against top jurisdictions indicates risks to competitiveness

- PR's strategic geographic location and foreign trade zone designation support pharma exports, but recent lackluster export performance signals risks to the outlook
- Declining pharma manufacturing contribution to economic growth
- Fragmented pharma temperature-controlled logistics
- Siloed information without sharing of best practices
- No coordinated planning for shared resources and routes
- Suboptimal cataloging and marketing of pharma and logistics assets
- Insufficient marketing of the island's capabilities
- Poor energy infrastructure for temperature-controlled logistics
- Bottlenecks in manual customs processes



Long-term competitiveness must address logistics infrastructure, data challenges and lack of visibility

- Global pharma cold chain trend requires strategic temperature-controlled warehousing
- Benchmarked jurisdictions score higher in key logistics categories impacting cold chain
- Cost reduction pressures drive need for reliable logistics cost data, frequent reporting and KPI monitoring
- Coordination among stakeholders is essential to protect the island's position in the global pharmaceutical market
- Need to stay current with industry marketing trends

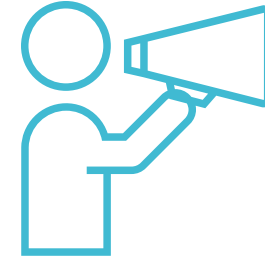
NOW



FUTURE



Build Pharma Temperature-
Controlled Ecosystem



Market Pharma Logistics
Capabilities

Recommendations

#1 Build pharma temperature- controlled ecosystem

Favorable global pharma cold chain market outlook and reshoring trend present opportunity to further develop pharma cold chain logistics market

Pharma remains critical to PR's manufacturing industry and economic growth, but must address declining trend

Pharma represents ~80% of total PR exports; PR is top 8 pharma world exporter, 4.5% of global pharma exports

Risk of losing competitiveness to major global pharma manufacturing jurisdictions with similar attributes to PR, such as Ireland or Singapore

Global Pharmaceutical & Medical Equipment Industry Overview

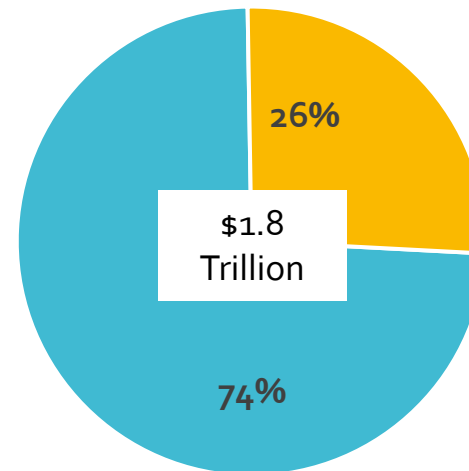
- Global \$1.3 trillion pharma industry expected to grow by 4-5% annually to reach \$1.5-\$1.6 trillion by 2024

- Pharma cold chain market accounts for 26%; expected to reach 28% by 2024, or \$440 billion

Global Pharma & Med. Equipment Industry Sales

(\$, Trillion)

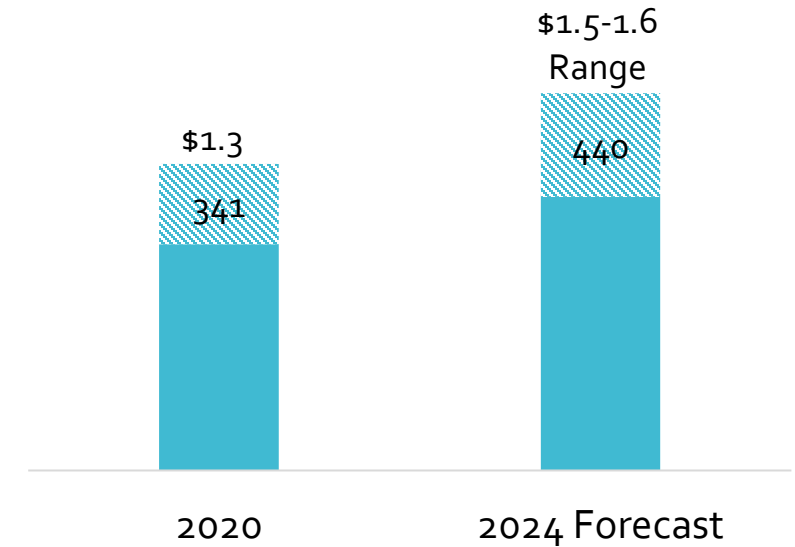
■ Pharmaceuticals ■ Medical Equipment



Global Pharma Sales Outlook

(\$, Trillion)

■ Non-Cold Chain ■ Cold-Chain



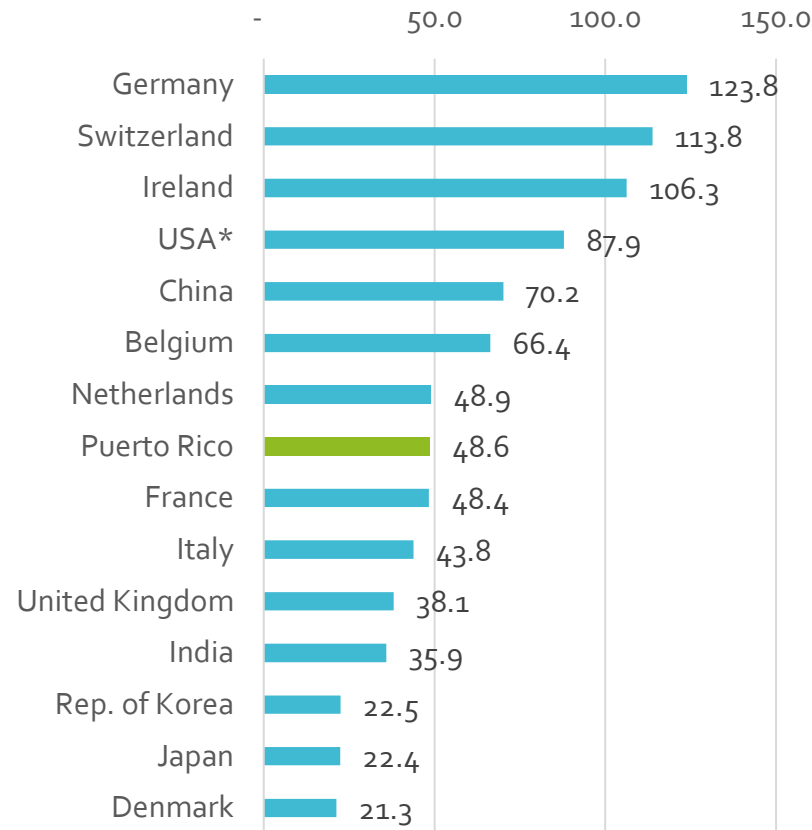
Sources: Fitch Solutions, Euromonitor International: Global Overview of the Pharmaceutical and Medical Equipment Industry, Pharmaceutical Commerce: 2020 Biopharma Cold Chain Sourcebook, EMAP Team Calculations

Top Pharma Exporters

- PR is top 8 pharma exporter and represents 4.5% of global exports (\$1.0 trillion)

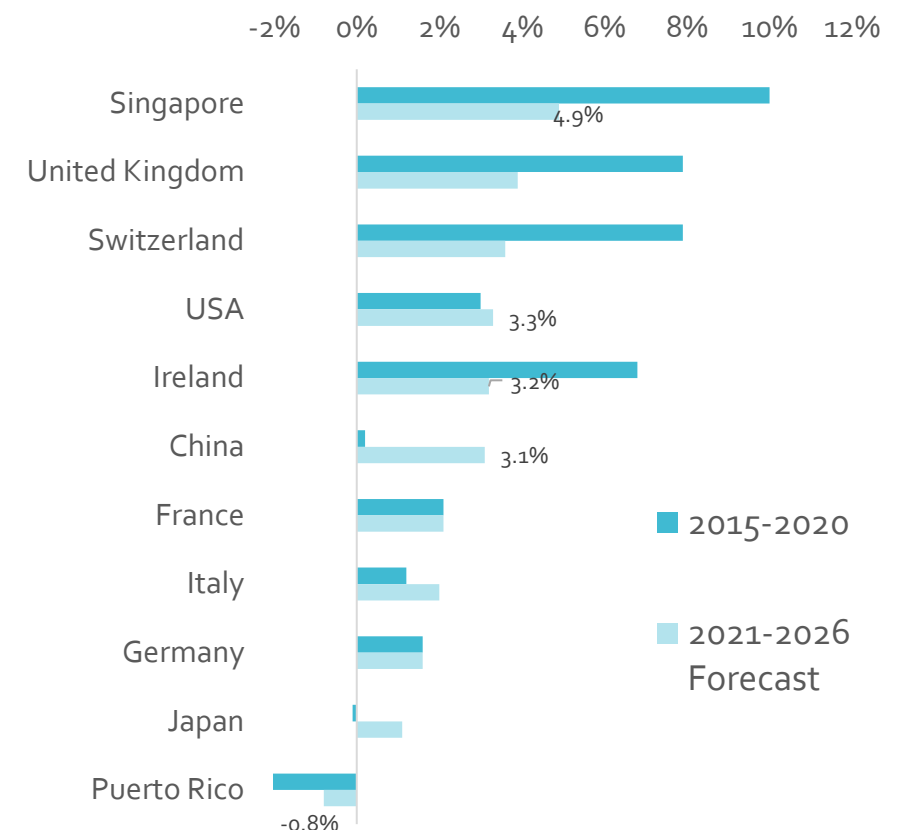
- Pharma production forecast to grow fastest in Singapore and slowest in PR

Top Pharma Exporters 2020 (\$, Billion)



Sources: UNCTAD (HS29+HS30). U.S. Includes PR data. PR data from Junta de Planificación de Puerto Rico's External Trade 2020 Tables (Table 10).

Pharma Production Outlook (Cumulative annual growth %)

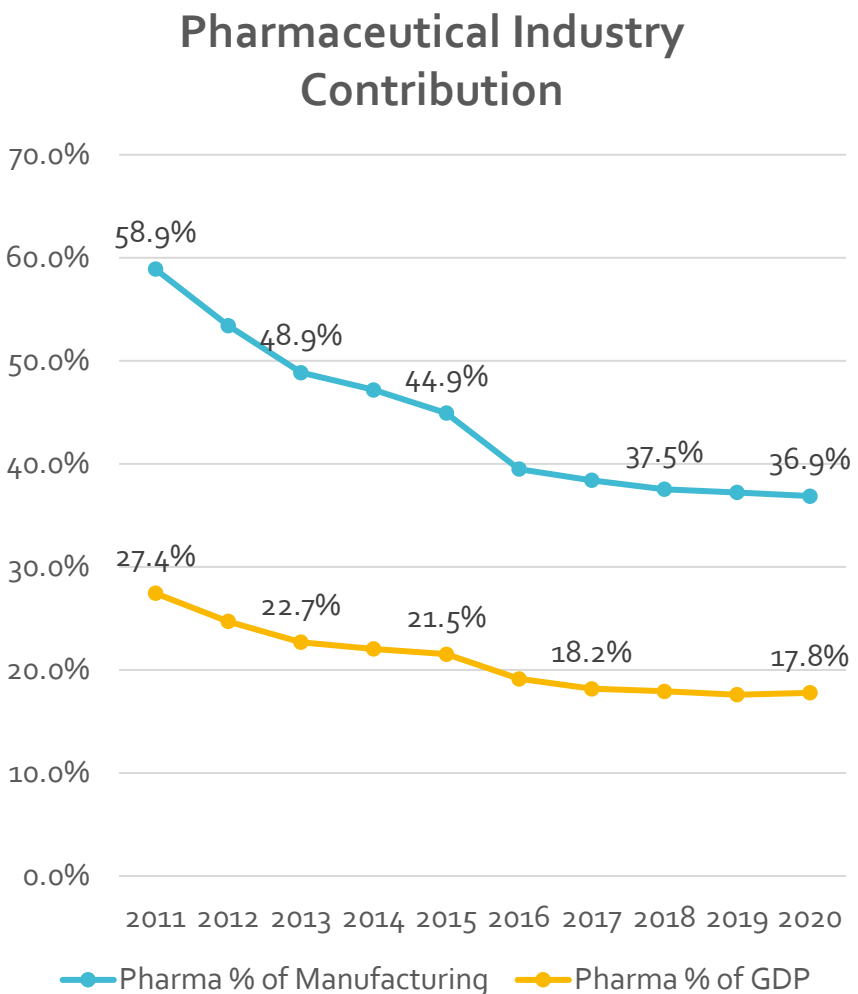


Source: Euromonitor International: Global Overview of the Pharmaceutical and Medical Equipment Industry

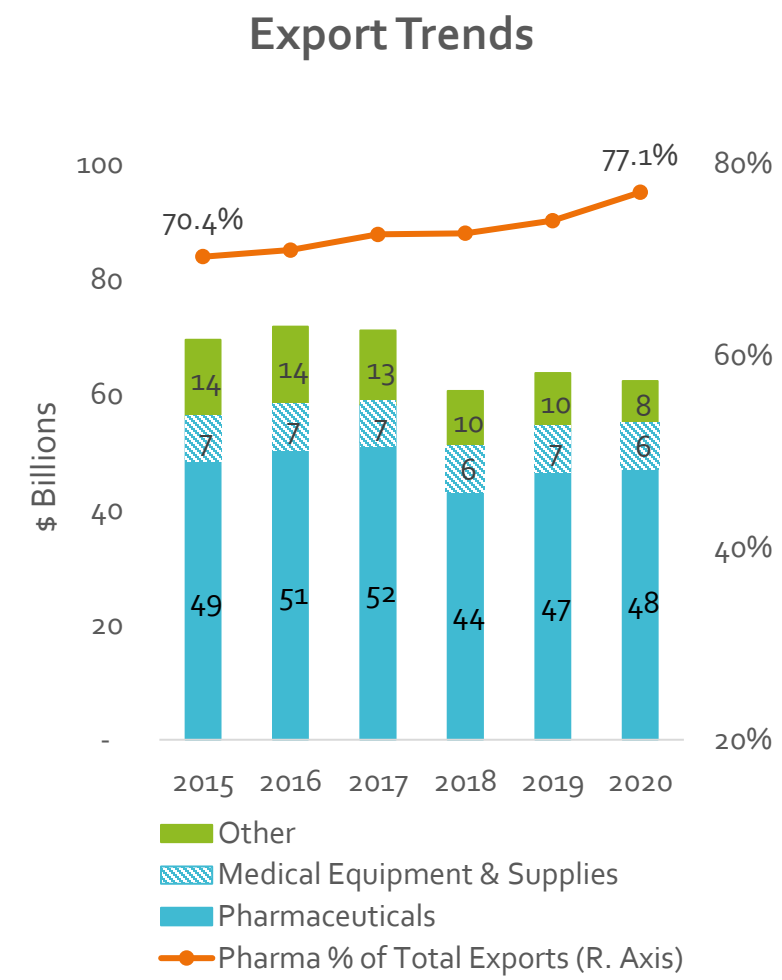
Puerto Rico Pharmaceutical Contribution To GDP, Manufacturing & Exports

-PR's pharma contribution to manufacturing and GDP on the decline, suggesting actions must be taken now to avoid becoming a stagnant market

- While the pharma contribution to total exports has been rising, this has been driven by a relatively larger decline in total exports



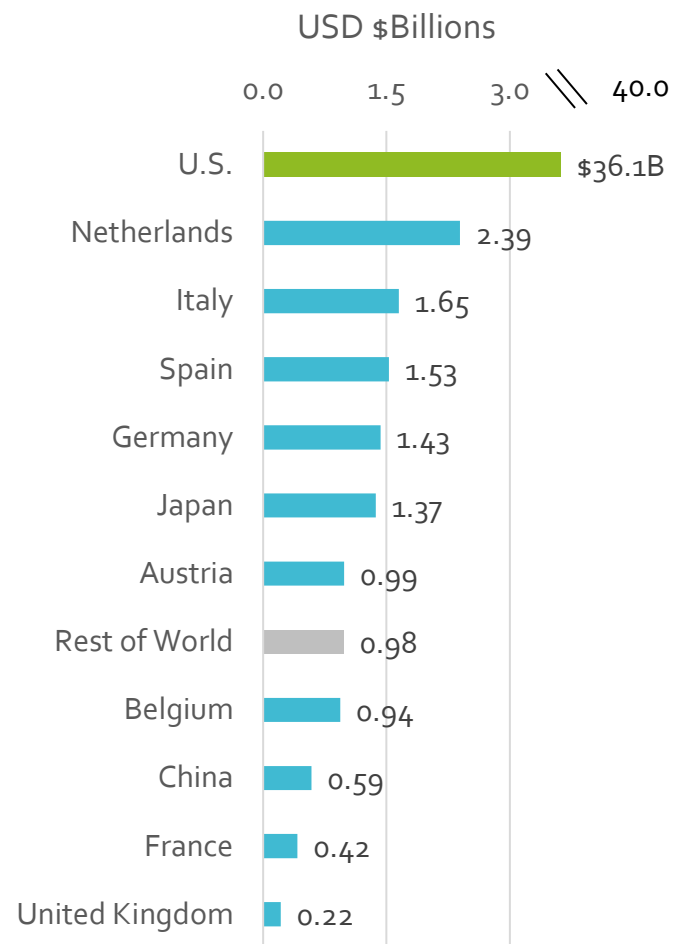
Source: Junta de Planificación de Puerto Rico.
Puerto Rico's Income and Product 2020 Tables (Table 10).



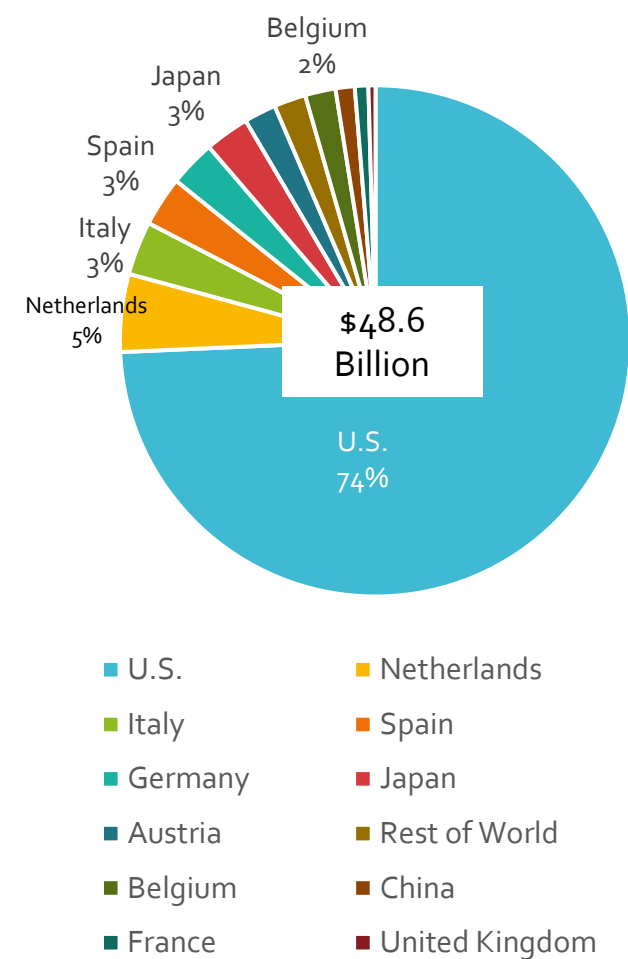
Source: Puerto Rico Planning Board, Program of Economic and Social Planning, Subprogram of Economic Analysis – Statistical Appendix of the Economic Report to the Governor 2020. Table 23.

Puerto Rico Pharmaceutical Exports

Top Export Destinations

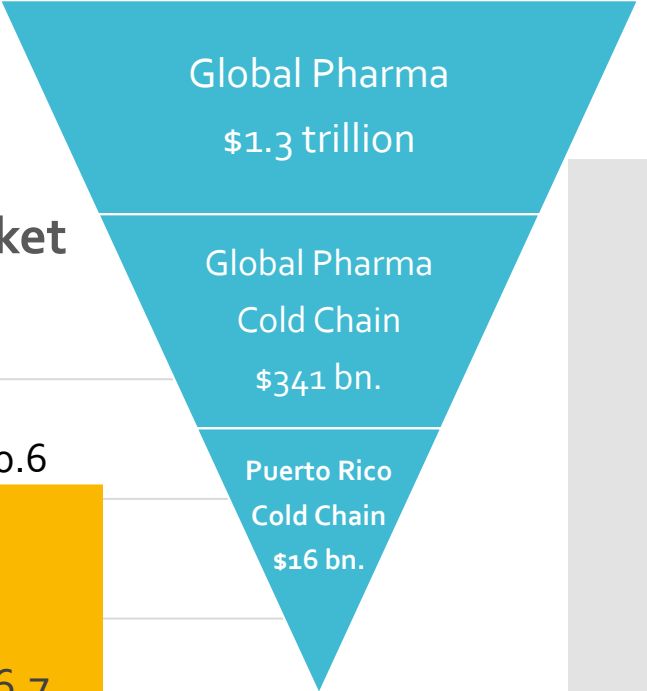
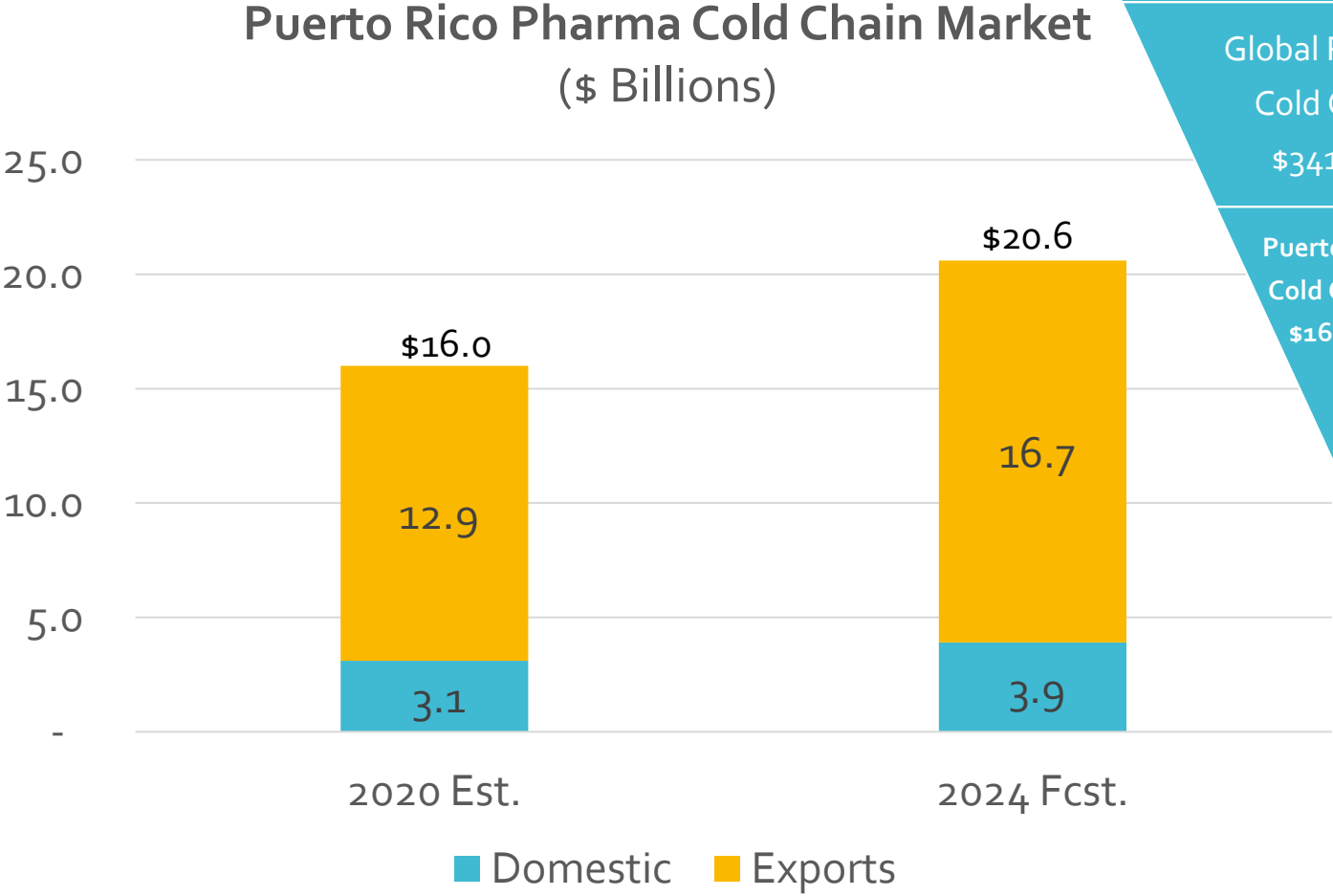


Export Share



Source: Junta de Planificación de Puerto Rico. Puerto Rico's External Trade 2020 Tables. EMAP team calculations: Pharmaceutical Products & Organic Chemicals trade include HS29 & HS30.

Puerto Rico
Pharma
Cold Chain (2 °C to 8 °C)
Market



Sources: Pharmaceutical Commerce: 2020 Biopharma Cold Chain Sourcebook, Junta de Planificación de Puerto Rico: Puerto Rico’s External Trade 2020 Tables (Table 10) and EMAP team calculations.



Benchmarking-Based Recommendations

PUERTO RICO



3.2 Million population (323/Km²)

\$103 Billion GDP

45+ Pharma Companies

90k Pharma Employees



\$44 Billion Pharma Production

\$49 Billion Pharma Exports

Congress phased out the tax break between 1996 and 2006..., spurred the **worst recession** in Puerto Rico's history. **Many companies left.**

WSJ

Puerto Rico Can Help The **U.S. End Its Dependence On Chinese Pharma** Ingredients

Forbes

IRELAND



5 Million population (72/Km²)

\$419 Billion GDP

85+ Pharma Companies

30k Pharma Employees



\$119 Billion Pharma Production

\$106 Billion Pharma Exports

*Ireland will play a central role in helping to put the EU's new pharmaceutical and industrial strategies into motion. The country is a **European pharmaceutical manufacturing hub** and the third largest exporter of pharmaceuticals in the world.*

PharmExec.com
MASTER THE SCIENCE OF SUCCESS

SINGAPORE



5.7 Million population (8360/Km²)

\$340 Billion GDP

50+ Pharma Companies

9k Pharma Employees



\$29 Billion Pharma Production

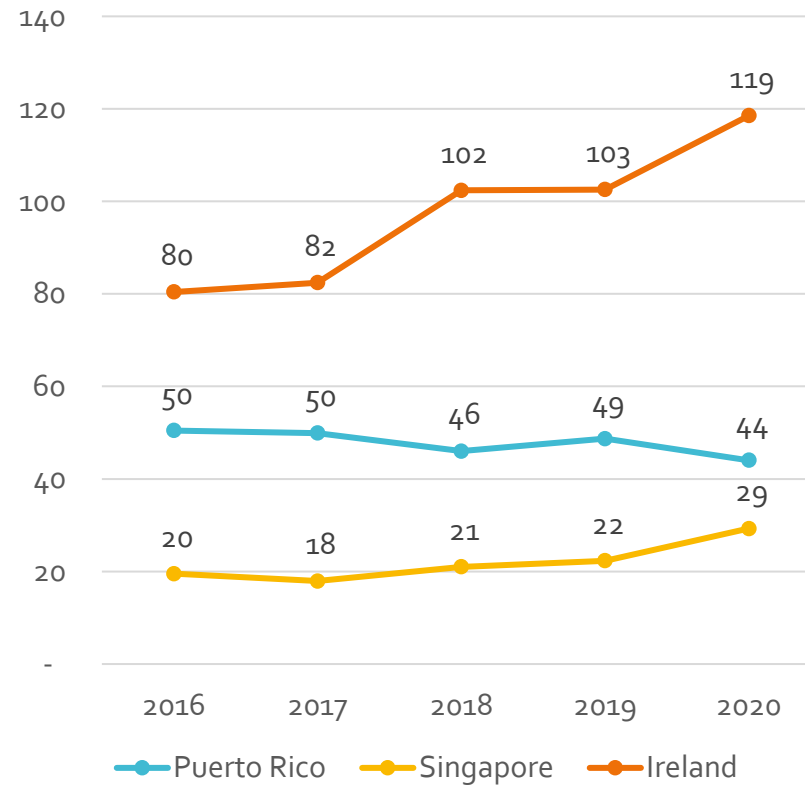
\$20 Billion Pharma Exports

Singapore is one of the **leading biomedical and pharmaceutical hubs in Asia**. Through the **government's Biomedical Sciences initiative...** launched in June 2000, Singapore has been able to attract both foreign and private investors that have moved the industry forward.

statista

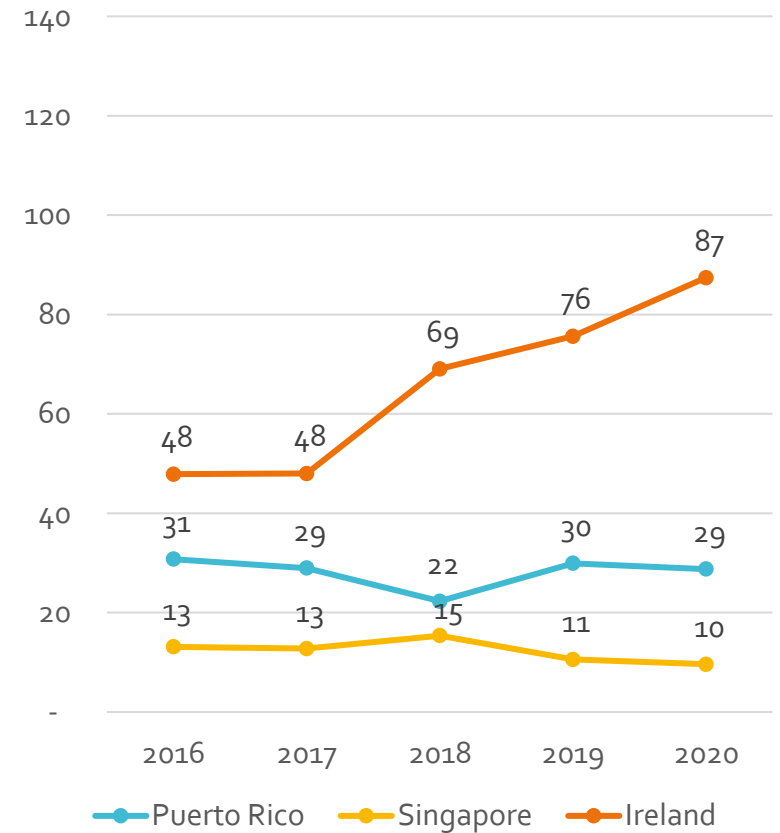
Pharmaceutical Production & Trade

Pharma Production
(\$ Billions, constant 2020 prices)



Sources: Euromonitor International, Passport database.

Pharma Net Exports*
(\$ Billions)



*Exports less imports

Source: UNCTAD; includes HS29 (org. chemicals) and HS30 (pharma prod.)

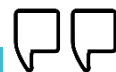
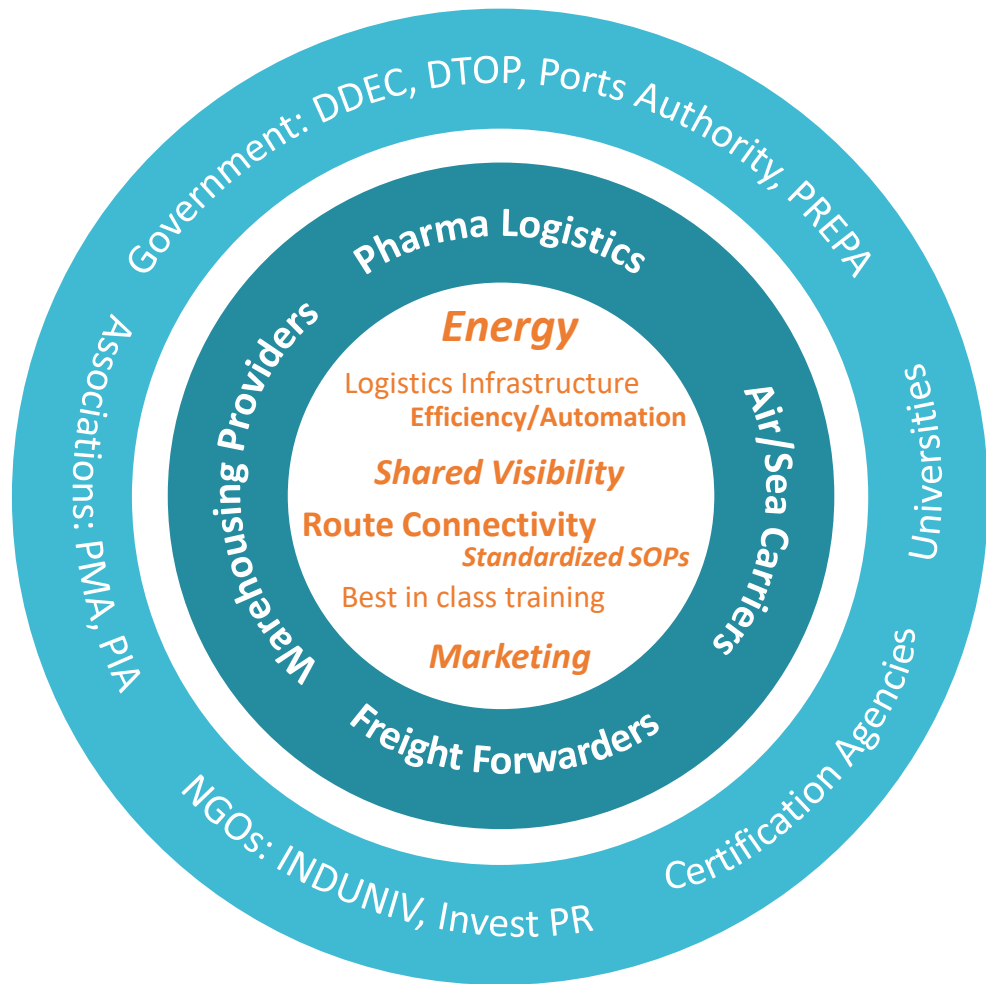
#1 Build Pharma Temperature- Controlled Ecosystem

How?

- A. Logistics Infrastructure
- B. Energy
- C. Training & Certifications



Proposed Ecosystem



We need to *establish best practices* on how to manage and store in a way that it provides *consistent results*

If we *work together* among the plants *and coordinate our deliveries* to increase pallets to ship to other areas. We need to get better data in/out of island.

Trying to have the *utilization structure on our island* that when needed, capacity is available. That is something PR can do better.

Four plants have four SOPs. Try to get it *standardized but it's a culture change*.

Everything is word of mouth

Now we need to make sure as an island we can *improve those costs* that are not directly related to the company, but *to make the whole better*. *As an island come together* to do better with power, water, facilities...



Community of Stakeholders

- Coordinate and Collaborate to *Keep the island competitive*
- Ensure common understanding of the status quo
- Prioritize shared concerns and produce integrative solutions and mitigation strategies

Learn from other jurisdictions

- *Singapore uses a multi-agency approach* with the government playing an orchestrating role
- *Many use* community-based approaches with *private-public sector collaboration* and memberships

A. Infrastructure

Strategic Warehousing Capacity

Puerto Rico

Insufficient Cataloging of Temperature-Logistics Warehousing

Company Name	City	Capacity (Sq ft)	Cold 2-8C	CRT 15-25C	Freeze < -20C	Pharma	Food
Cesar Castillo, Inc.	Guaynabo	850,000	✓	✓	✓	✓	
DHL Supply Chain	Catano	400,000	✓	✓	✓	✓	✓
Munoz Holdings, Inc.	San Juan	270,520					
VWR Part of Avantor	Manati	133,000	✓		✓		
CBX Global	Aguadilla + Carolina	75,000	✓	✓			
Martin-Brower P.R. Inc.	Toa Baja	62,000	✓	✓	?		✓
Sea Air Systems, Inc.	Guaynabo	35,000					
RR Donnelley de P.R. Corp.	Catano	30,000					
Distribution Integrated Services	Guaynabo	30,000					
Isla Frio	Cidra	90,000	✓	✓	✓	✓	✓
PrimeAir	San Juan	24,000	✓	✓		✓	

Singapore – Changi Airport

Highly Competitive Warehousing Competencies

Company Name	Capacity (Sq ft)	Cold 2-8C	CRT 15-25C	Freeze < -20C	Pharma	Food
Bollore	21,000	✓	✓	✓	✓	
Ceva	3,200	✓	✓		✓	✓
DB Schenker		✓	✓		✓	
DHL Global Forwarding	77,000		✓		✓	✓
DSV Air & Sea		✓	✓	✓	✓	✓
Kuehne + Nagel	150,000	✓	✓		✓	
Global Airfreight intl		✓	✓		✓	
Expeditors	74,000	✓	✓		✓	✓
UPS	40,000	✓	✓	✓	✓	✓
Singapore Airlines	1,800 flights/week	✓	✓	✓	✓	✓
Dnata	4,600	✓	✓	✓	✓	✓
SATS	26,000	✓	✓	✓	✓	✓

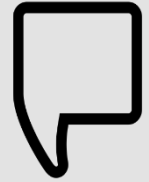
Ireland

Variability by Location & Stored Product Type

Company Name	City	Capacity (Sq ft)	Cold 2-8C	CRT 15-25C	Freeze < -20C	Pharma	Food
Marken	Dublin		✓	✓	✓	✓	
Swift Freeze	Dublin					✓	
Agro Merchants Group	Dublin	27,000	✓		✓	✓	✓
Seko	Dublin	20,000	✓	✓		✓	
CMLS	Dublin , Limerick & Shannon	100,000	✓	✓			✓
Caffrey International	Ashbourne	60,000	✓			✓	✓
Worldwide Flight Services	Cork Airport	1,525					
Dublin Airport Business Center							
IAG Cargo	Terminal 1	20,000	✓			✓	
Worldwide Flight Services	Terminal 1		✓	✓	✓	✓	✓
Horizon Logistics Park							
CEVA	Close to Dublin Airport	15,000	✓		✓		
DHL		40,000	✓	✓	✓		
Kintestu World Express		9,840			✓		
Fynes Logistics		25,000	✓		✓	✓	
Kuehne + Nagel		100,000			✓		
Expeditors		26,000					

A. Infrastructure

Strategic Warehousing Location



*“We need
temperature-
controlled
warehousing at the
airport”*

Puerto Rico

SJU



- 8.4 million passengers
- Load factor 87.14
- Largest runway in the Caribbean

BQN

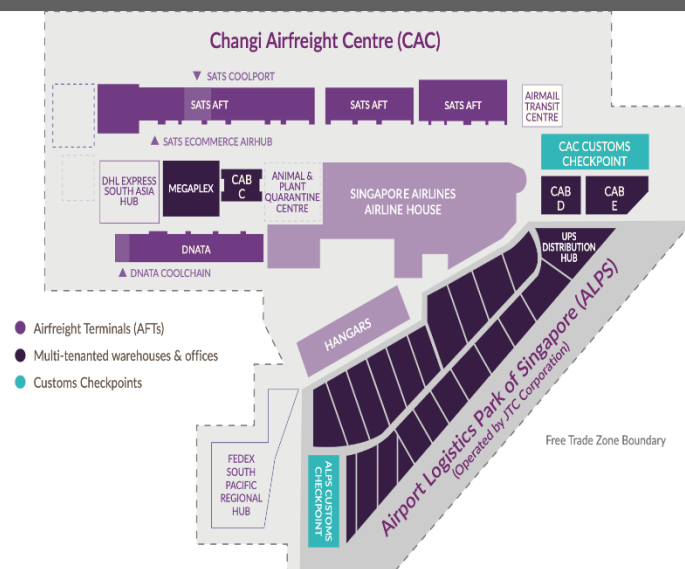


- 472,000+ passengers
- Substantial area for greenfield development
- 1,600 acres of idle land at southside

Are there opportunities to build logistics parks at SJU & BQN airports for pharmaceuticals?

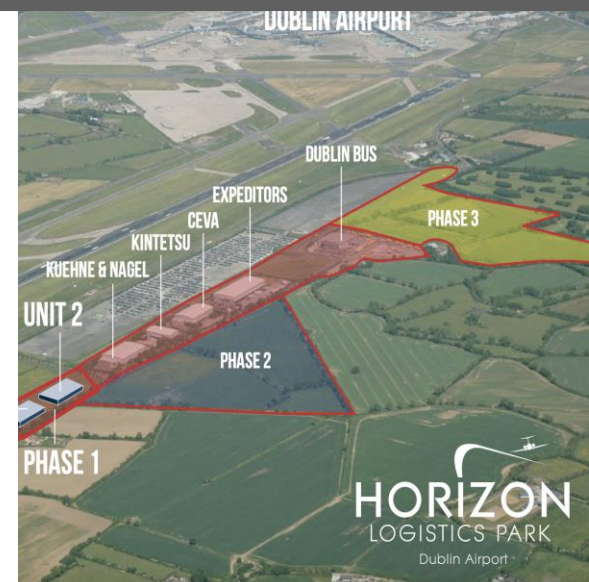
Singapore & Ireland

SINGAPORE: AIR LOGISTICS PARK



- Regional distribution/fulfillment centers
- 170 acres
- > 115,000 Sq Ft warehousing capacity

IRELAND, DUBLIN: HORIZON LOGISTIC PARK



- Dedicated warehousing and distribution development
- 125 acres
- > 150,000 Sq Ft warehousing capacity

A. Infrastructure

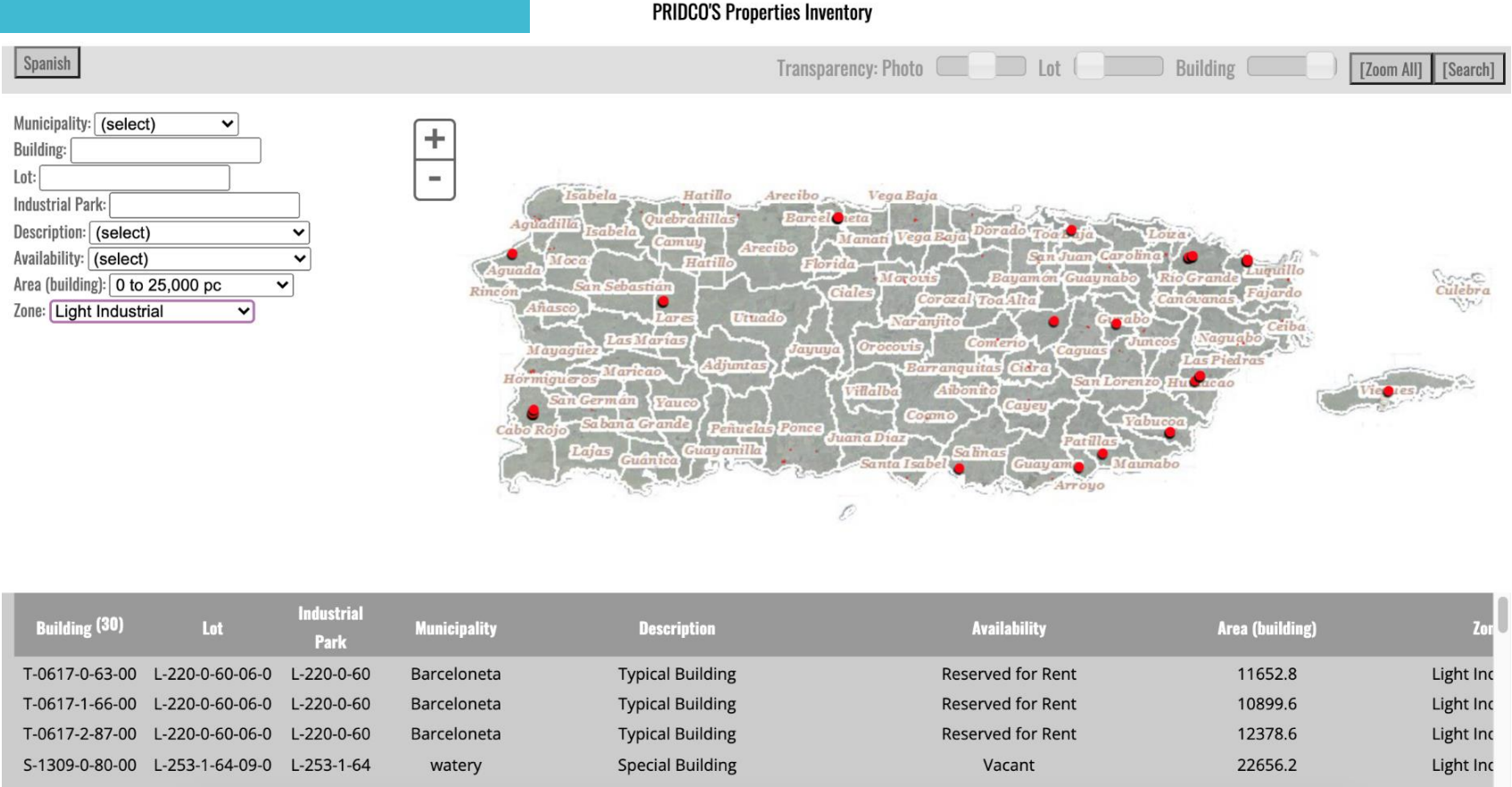
Move-in-Ready Facilities



“Buildings are not in good shape and no new ones are being constructed”

Puerto Rico

PRIDCO-owned facilities



107 Industrial parks with over 22 million square feet space: Opportunity to market stale website

Singapore Sustainable Industrial Development

/ ALL PROPERTIES /

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Industrial Land

- **Specialised Industrial Park**
 - Airport Logistics Park of Singapore
 - Jurong Island
 - LogisParks
 - MedTech Park
 - Offshore Marine Centre
 - Seletar Aerospace Park
 - Sungei Kadut Eco-District
 - Tuas Biomedical Park
 - Wafer Fab & Advanced Display Parks
- **Business Park**
 - Changi Business Park
 - CleanTech Park
 - International Business Park
 - Jurong Innovation District
 - Mediapolis
 - one-north
 - Punggol Digital District

Space

- **Ready-built Space**
 - Biopolis
 - Bulim Square
 - Design Orchard
 - Flatted Factories
 - Fusionopolis
 - JTC aeroSpace @ Seletar Aerospace Park
 - JTC Aviation One @ Seletar Aerospace Park
 - JTC Aviation Two @ Seletar Aerospace Park
 - JTC Bedok Food City
 - JTC Chemicals Hub @ Tuas South
 - JTC CleanTech One @ Jurong Innovation District
 - JTC CleanTech Two @ Jurong Innovation District
 - JTC CleanTech Three @ Jurong Innovation District
 - JTC Food Hub @ Senoko
 - JTC Logistics Hub @ Gul

ADDRESS

[Biopolis](#)

INDUSTRY

Biomedical

TYPE / USE

Business Park

GFA

185,000 sqm

UNIT SIZE

266.9 - 696.3 sqm

FLOOR PLAN

N/A

RENTS

LOCATION	LEVEL	BUILDING RENT (\$ psm per month)	SERVICE CHARGE (\$ psm per month)
Biopolis			
Office	All	38.90	13.40
Lab	All	38.51	8.09
Lab	Basement	25.21	8.09

Important Notes:

- All building rents and charges quoted are subject to the prevailing GST.
- Rates indicated may change at the point of offer due to changes in market conditions.
- The rates and other information contained herein are applicable at time of printing and are subject to change without prior notice.



Jurong Town Corporation (JTC) developed 7,000 hectares of industrial land and 4 million square meters of ready-built facilities

Ireland

Business and Technology Parks

[Invest in Ireland](#)[How we help](#)[Doing business here](#)[About IDA Ireland](#)[News](#)

Available: Waterford - Manufacturing Facility, Waterford

Prime self-contained manufacturing facility located on a c. 0.97 hectares (2.41 acre) site on IDA's Waterford Industrial Estate. This property comprises c. 3,489 sq m (c. 37,555 sq ft) of manufacturing, cleanroom, warehouse and office space.



Dublin/East - College Park Dublin

College Park has been developed as a joint venture between Fingal County Council and IDA Ireland.



Dublin/East - Grange Castle Business Park

Grange Castle Business Park is a world class campus with world leading clients, largely because of their model of continuous investment and planning over 20 years



A. Infrastructure

Logistics Key Performance Indicators (KPIs)

The International Association of Refrigerated Warehouses observed strong correlation of cold chain performance with a country's transport rating



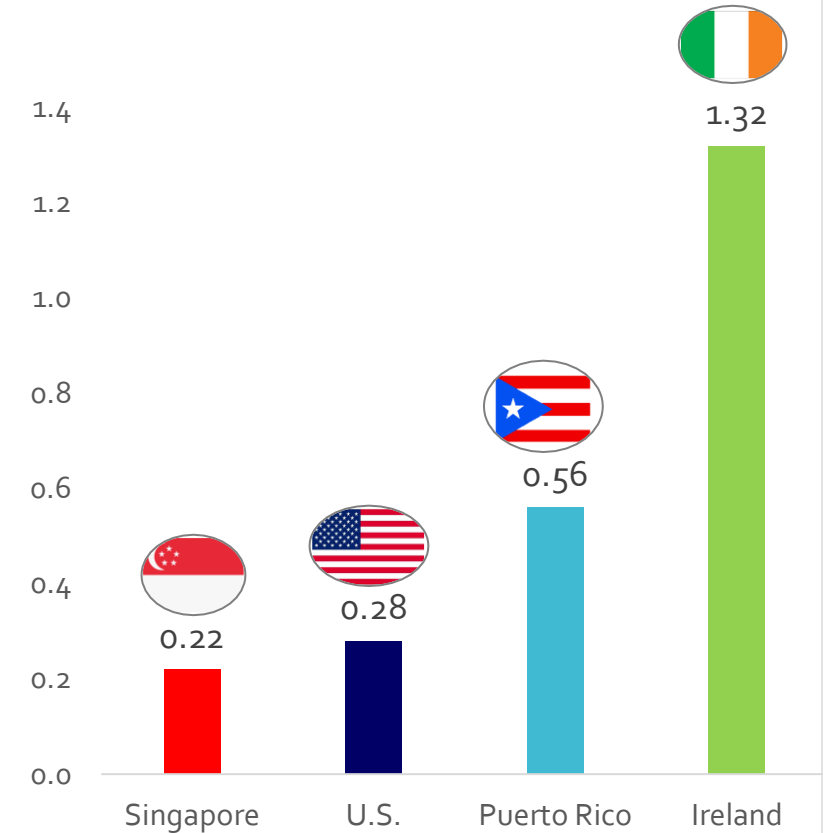
Logistics KPIs

- Puerto Rico lacks logistics performance metrics for global benchmarking

World Bank Logistics Performance Index

Country	<u>Singapore</u>	<u>United States</u>	<u>Ireland</u>
<u>LPI</u>			
Rank (out of 160)	7	14	29
Score	4.0	3.9	3.5
<u>Customs</u>			
Rank (out of 160)	6	10	26
Score	3.9	3.8	3.4
<u>Infrastructure</u>			
Rank (out of 160)	6	7	29
Score	4.1	4.1	3.3
<u>International shipments</u>			
Rank (out of 160)	15	23	28
Score	3.6	3.5	3.4
<u>Logistics competence</u>			
Rank (out of 160)	3	16	26
Score	4.1	3.9	3.6
<u>Tracking & tracing</u>			
Rank (out of 160)	8	6	28
Score	4.1	4.1	3.6
<u>Timeliness</u>			
Rank (out of 160)	6	19	33
Score	4.3	4.1	3.8

Port Efficiency* (Containers TEU per Minute)



Sources: World Bank, 2018 Logistics Performance Index; UNCTAD Port Call & Performance Statistics. * Port efficiency calculated by using median time in port and average container carrying capacity (TEU) per container ship.



FILL GAP ON TEMPERATURE-
CONTROLLED WAREHOUSING
CAPACITY DATA



ADMINISTER TEMPERATURE-
CONTROLLED SURVEY



CATALOG MOVE-IN READY
LARGE FACILITIES



DEVELOP LOGISTICS KPIS FOR
BENCHMARKING

Recommendations - Infrastructure

Puerto Rico Warehouse Capacity Survey

Administer annual temperature-controlled survey to catalog warehousing capabilities

Puerto Rico - Warehouse Capacity Survey		
1. What is the name of your business?		
<div></div>		
2. What type of business are you considered? (select one)		
Manufacturing		
Logistics Provider		
Carrier		
3. What type of products do you warehouse/store? (select all that apply)		
Pharmaceutical		
Food		
Other (please specify)	<div></div>	
4. What is your current total warehouse / storage capacity?		
<div></div>	SqFt	<div></div>
5. What is your average number of pallet positions dedicated to pharma?		
<div></div>	pallet positions	<div></div>
6. Do you have plans to increase your total warehouse / storage capacity?		
Yes	No	<div></div>
7. Do you offer temperature-controlled storage?		
Yes	No	<div></div>
8. If yes , please select all that apply. If no , select Not Applicable.		
controlled room temp 15 °C to 25 °C		
cold chain 2 °C to 8 °C		
freezer -25 °C to -10 °C		
other (please specify)	<div> °C to °C</div>	
Not Applicable		

9. If you selected yes in the previous question, how many square feet (SqFt) for each temperature? If you selected no, select Not Applicable.	
controlled room temp 15 °C to 25 °C	<div> SqFt</div>
cold chain 2 °C to 8 °C	<div> SqFt</div>
freezer -25 °C to -10 °C	<div> SqFt</div>
other (please specify)	<div> SqFt</div>
Not Applicable	<div></div>
10. What supply chain training does your company have? (select all that apply)	
GDP	<div></div>
Other (please specify)	<div></div>
11. What certification does your company have? (select all that apply)	
CEIV	<div></div>
Other (please specify)	<div></div>
12. Do have any of these additional capabilities? (select all that apply)	
Dry ice top up	<div></div>
Liquid nitrogen top-up	<div></div>
Charging facilities for active containers	<div></div>
Replacement of gel packs	<div></div>
Hazardous waste management	<div></div>
Other (please specify)	<div></div>
13. For energy reliability, what redundancy (backup) do you have? (select all that apply)	
Gas generator	<div></div>
Solar panels	<div></div>
Other (please specify)	<div></div>

B. Energy

Electricity Costs & Reliability

15% of total cold chain pharmaceutical logistics operation costs is power

55% of cost in temperature-controlled warehousing due to refrigeration

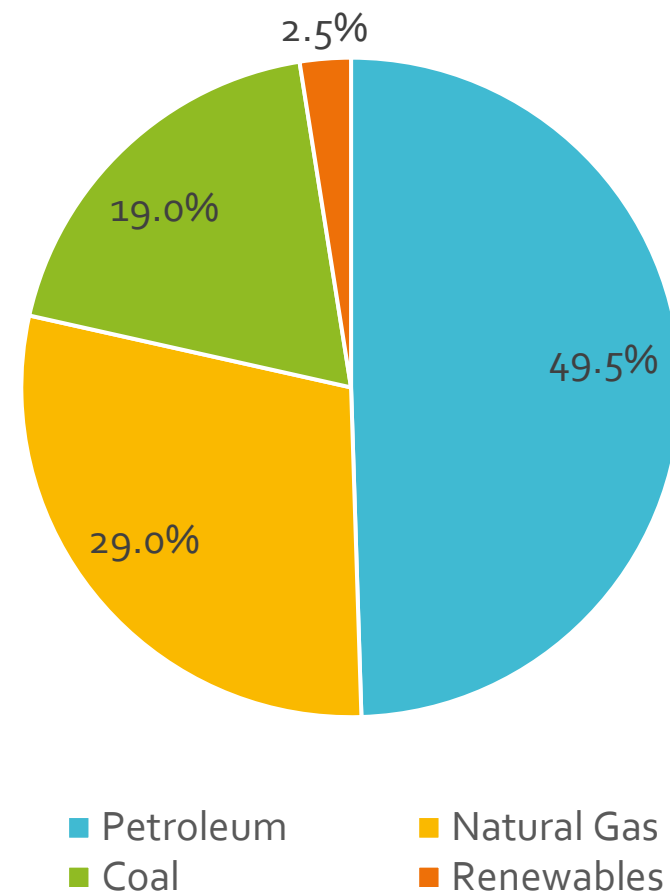
Technavio

Puerto Rico Electricity Supply

- A resilient electricity grid is necessary to support rising demand for temperature-controlled logistics
- Electricity supply is heavily dependent on imported petroleum and natural gas, contributing to high costs
- Under Puerto Rico's 2019 Energy Public Policy Act, PREPA* must obtain 40% of electricity from renewable sources by 2025
- As of 2020, renewables only made up 2.5%
- Explore renewable power generation to make the electricity grid more resilient to disruptions
- Include PREPA and the Puerto Rico Energy Bureau in temperature-controlled ecosystem

* Puerto Rico Electric Power Authority

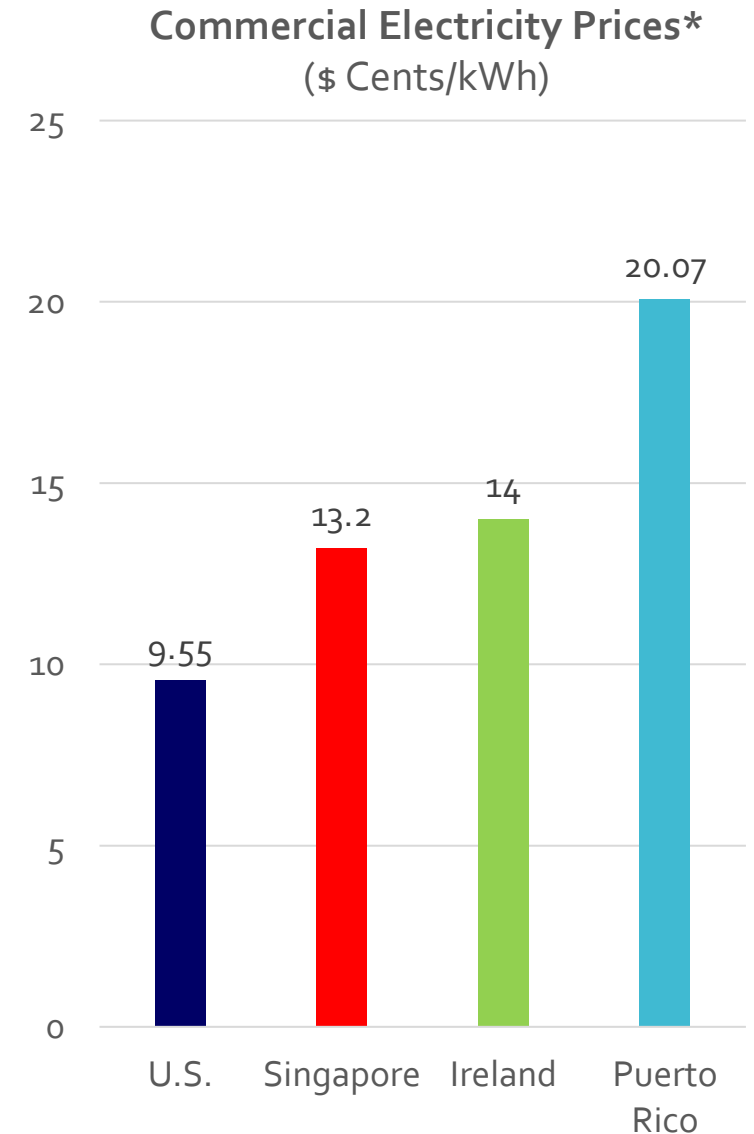
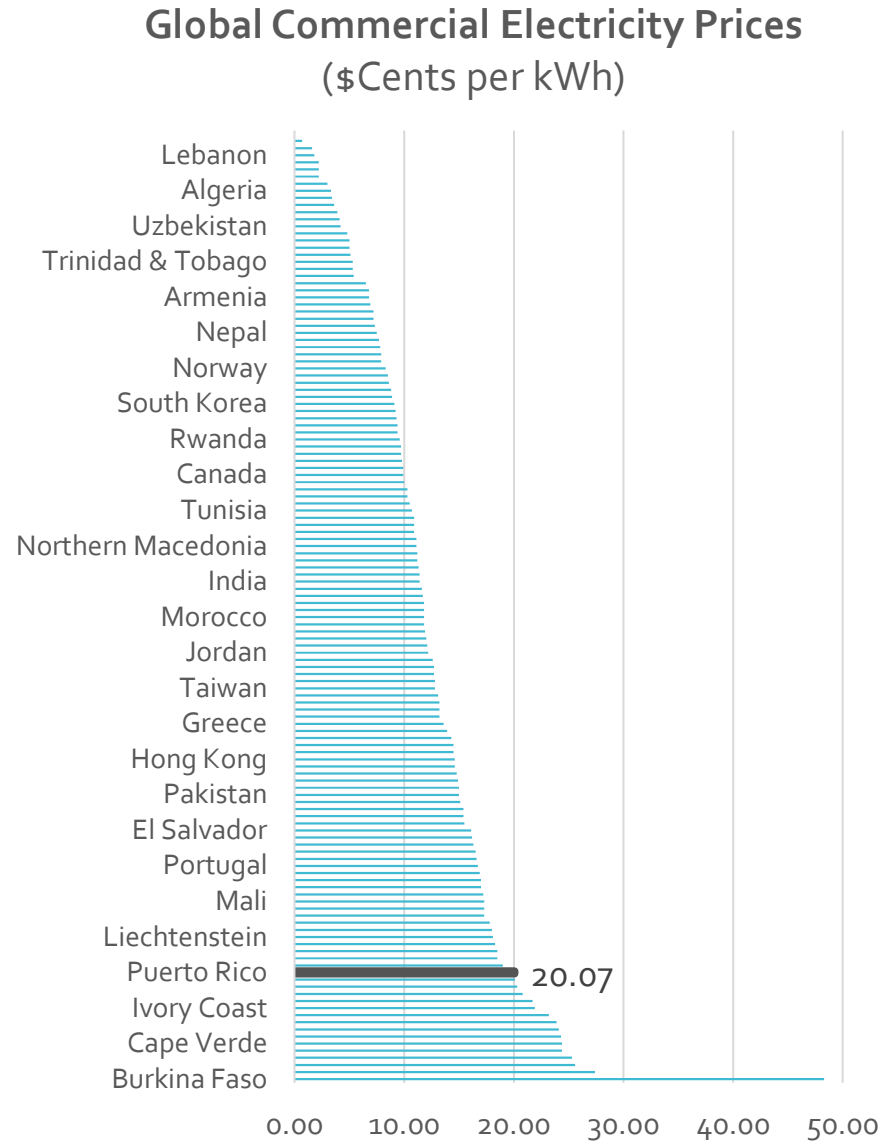
Electricity Supply Sources



Source: EIA: Puerto Rico Territory Energy Profile

Electricity Costs

- Puerto Rico has one of the world's highest commercial electricity prices; 2X as much as mainland U.S.



Sources: https://www.globalpetrolprices.com/electricity_prices/, <https://www.seai.ie/data-and-insights/seai-statistics/key-statistics/prices/>, <https://www.eia.gov/state/print.php?sid=RQ>

* Puerto Rico & U.S. prices as of July 21 (average of commercial + residential), Singapore as of March 21, Ireland as of Second Half 2020.

Electricity Reliability



J.D. Power - Electric Utility Residential Customer Satisfaction Study

- Puerto Rico Electric Power Authority (PREPA) ranked last out of 144 U.S. utility companies measured
- PREPA score was approximately 50% lower than the average utility company
- 47% lower than the next comparable lowest ranking utility

LUMA Energy performance metrics submitted to the Puerto Rico Energy Bureau (PREB)

- Power outage frequencies are 300% worse than the next worse performer
- Duration of outages is 200% worse
- PREPA's performance is continuing to degrade by more than 20% annually

Electricity Reliability KPIs

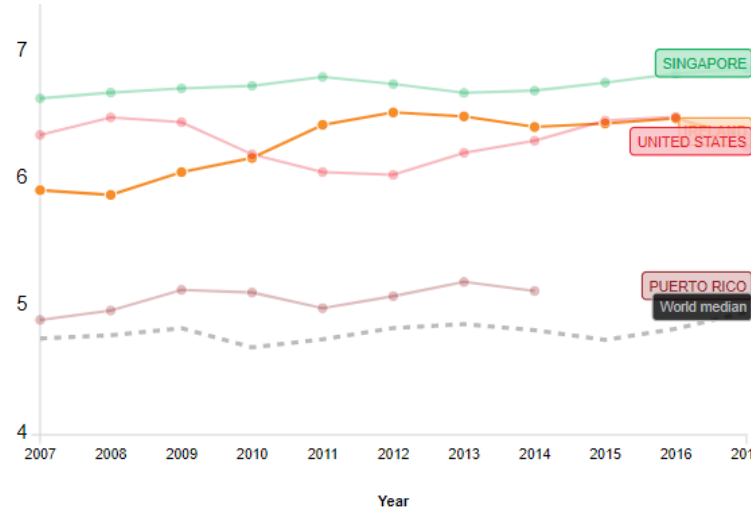
- High frequency of service interruptions and duration represent major challenges for cold chain in the form of redundancy costs and excursion potential

- Puerto Rico's quality of electricity data frequency lagging relative to top pharma jurisdictions

Doing Business Survey Quality of Electricity Metrics

	PR	Ireland	Singapore	US NYC
Reliability of supply (0-8)	3	8	7	8
Average interruption duration*	14.4	0.8	0.1	0.2
Average interruption frequency**	4.8	0.6	0.1	0.0

Source: : World Bank Doing Business ("Getting Electricity")



Source: : World Economic Forum, Global Competitiveness Index.

Quality of Electricity Supply Rank (1-7) Top 30 Countries

Rank/137	Country / Economy	Score	Trend	Distance from best
1	Norway	6.9	↗	0
2	Switzerland	6.9	↗	0
3	Singapore	6.9	↗	0
4	Hong Kong SAR	6.8	↗	0
5	Denmark	6.8	↗	0
6	Netherlands	6.8	↗	0
7	France	6.8	↗	0
8	Luxembourg	6.7	↗	0
9	Finland	6.7	↗	0
10	Japan	6.7	↗	0
11	Iceland	6.7	↗	0
12	United Kingdom	6.7	↗	0
13	Canada	6.6	↗	0
14	Austria	6.6	↗	0
15	Sweden	6.6	↗	0
16	United Arab Emirates	6.5	↗	0
17	New Zealand	6.5	↗	0
18	Czech Republic	6.5	↗	0
19	Belgium	6.5	↗	0
20	Qatar	6.5	↗	0
21	Korea, Rep.	6.4	↗	0
22	Slovenia	6.4	↗	0
23	Israel	6.4	↗	0
24	Ireland	6.3	↗	0
25	Spain	6.2	↗	0
26	United States	6.2	↗	0
27	Portugal	6.2	↗	0
28	Oman	6.2	↗	0
29	Germany	6.2	↗	0
30	Saudi Arabia	6.2	↗	0

Source: : World Economic Forum, Global Competitiveness Index 2018.

"In your country, how reliable is the electricity supply (lack of interruptions and lack of voltage fluctuations)? [1 = extremely unreliable; 7 = extremely reliable]"

Energy Redundancy Costs



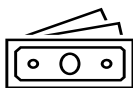
Initial Energy Redundancy Capital Expenditure

\$2-\$3 Million for generators



Monthly Preventative Equipment Maintenance

\$400-\$500 (not including parts)



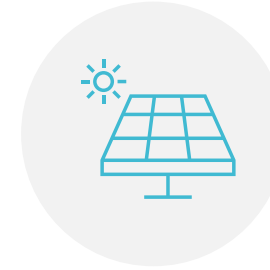
Per Power Outage Operational Costs

average power outage 3 hrs

\$342 - \$855 per event



INCLUDE INFLUENTIAL ENERGY DECISION MAKERS
(I.E. PREPA AND PREB) IN ECOSYSTEM TO JOINTLY
ADDRESS ENERGY RELIABILITY & COST ISSUES



INCENTIVIZE PRIVATE-SECTOR ADOPTION OF ALTERNATIVE
SOLUTIONS, SUCH AS RENEWABLES, TO IMPROVE
AFFORDABILITY & RELIABILITY OF ENERGY SUPPLY
IMPACTING COLD CHAIN

Recommendations - Energy

C. Training & Certifications

Training and developing the manpower on the technology and handling the products involve heavy capital involvement and it remains the necessity of industry...



Due to broken cold chain...

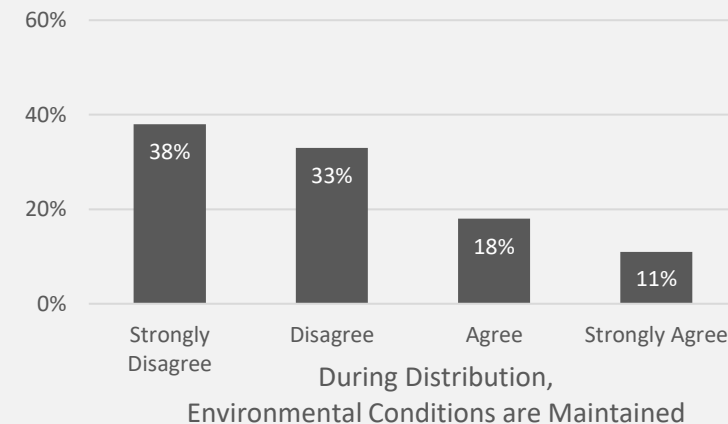
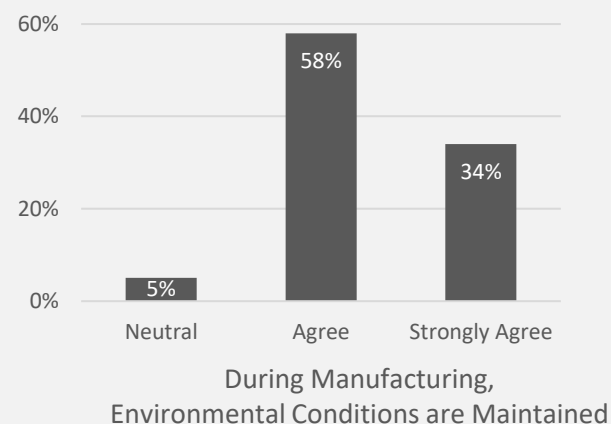
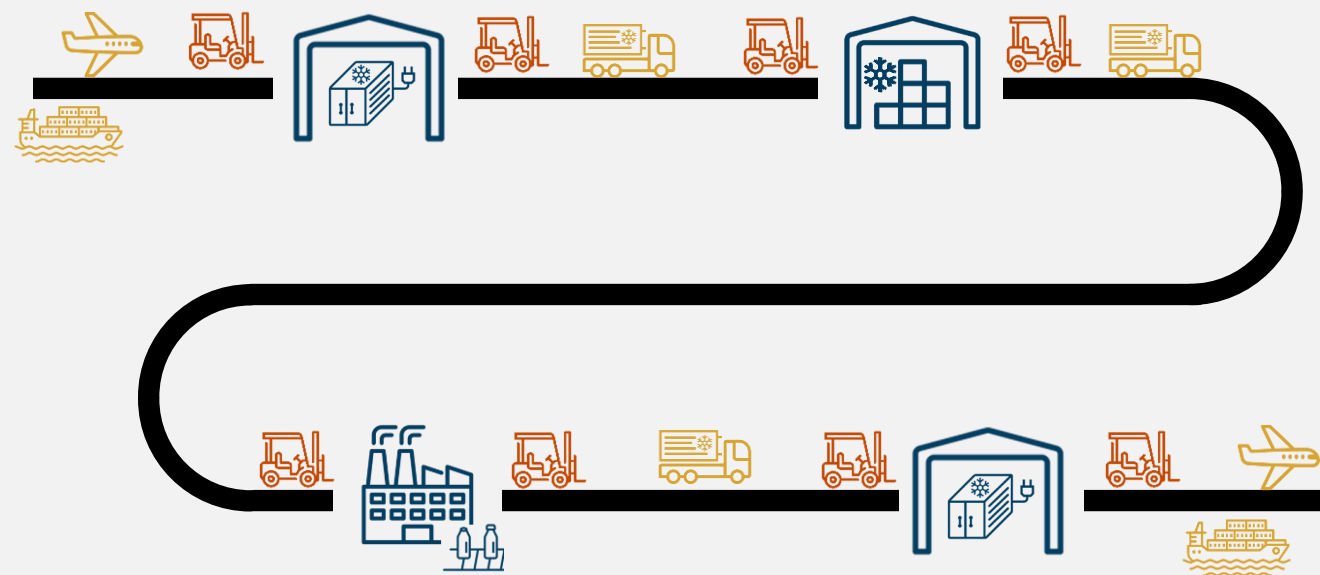
20% Products Wasted
\$35b Annual Loss Globally

Risk of **damaged** or degraded **products** getting to patients

Expensive retrospective root cause analysis

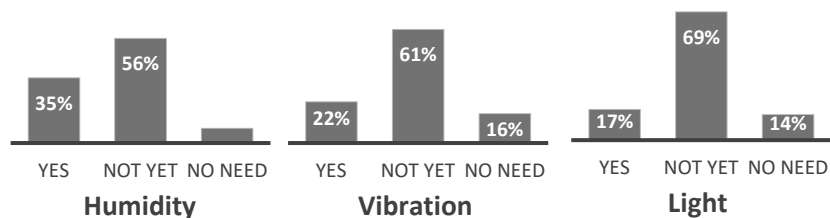
Demand is surging for **specialized, temperature-controlled logistics services** to safely, reliably and cost-effectively distribute high value, high-sensitivity products.

Highest Risk of Excursions during **transport** and **product handling**, 90% from human error



Industry Trends

- Community training and Certification, e.g. **IATA CEIV Pharma**
- **High performance packaging** materials, technology, and methods
- **End-to-end shared visibility**
- **Real-time monitoring & analytics**
Connected monitoring used with advanced analytics to readjust temperatures, reroute shipments
- **Monitoring beyond temperature**



Shared excellence

- Ensure uniform product handling processes through community training
- Create a forum to share best practices
- Market your qualifications

Push to the frontier of technology

- Prepare for the future
- Gain expertise on 360 environmental monitoring
- Follow the latest industry technology trends in real-time monitoring and analytics to stay ahead of the game

Training , Technology



*We secure our cargo **with extra insulation** to prevent excursions...*

*When excursions happen, **we work with our 3PLs to improve...***

*You want to be aware where your **product is at what temperature, etc.** Some of the key companies use sensors that provide data. **In PR, there are only a few that do this..... but many do not. There is room for more companies to have this capability.***



Changi has **highly trained specialists** to handle temperature-controlled shipments



Schiphol brands itself as **Qualified and Transparent**

Puerto Rico

Limited shared training and certification prohibits shared level of excellence

Company Name	Product Tracking Capability	Temp. Monitoring	Additional Capability	Certification
Cesar Castillo, Inc.	End-to-end visibility	✓	Hazardous Waste	
DHL Supply Chain	Life science DHL IT Platform	✓		GDP & CEIV
Munoz Holdings, Inc.				
VWR Part of Avantor	Order Status tracking			
CBX Global	Shiptrax & Quictrax	✓		GDP
Martin-Brower P.R. Inc.	End-to-end visibility	✓		
Sea Air Systems, Inc.				
RR Donnelley de P.R. Corp.				
Distribution Integrated Services				
Isla Frio	Real time visibility	✓		
PrimeAir	GPS tracking	✓	Hazmat certified	CEIV

Singapore – Changi Airport

Leading in training and certification with Pharma@Changi CEIV Community

Company Name	Product Tracking Capability	Temp. Monitoring	Additional Capability	Certification
Bollore	End-to-end Traceability	✓	Mobile freezers & charging	GDP & CEIV
Ceva	Monitor shipments 24/7	✓	Dry ice	GDP & CEIV
DB Schenker	AirTrack - GPS tracking		Dry ice	GDP & CEIV
DHL Global	DHL IT platform	✓	Charging for Envirotainers	GDP & CEIV
DSV Air & Sea	SmartView online platform	✓		GDP & CEIV
Kuehne + Nagel	Cargo Signal	✓	Dry Ice & Liquid Nitrogen	GDP & CEIV
Global Airfreight intl	GPS tracking	✓	Dry Ice & Liquid Nitrogen	GDP & CEIV
Expeditors	Cargo Signal	✓	Generator with standby fuel tank	GDP & CEIV
UPS	GPS tracking	✓		GDP & CEIV
Singapore Airlines	Real-time digital control tower	✓	Charging for containers	CEIV
Dnata		✓	Charging for containers	CEIV
SATS		✓	Dry-ice production	CEIV

Ireland

Variability in type of training and certifications

Company Name	Product Tracking Capability	Temp. Monitoring	Additional Capability	Certification
Marken	Marken Maestro™ & Sentry	✓	Temp controlled pack	GDP & GMP
Swift Freeze (Tower Co. partnership)	Data Loggers	✓	Temp controlled ship & pack	CEIV
Agro Merchants Group				
Seko	Track and Manage	✓		GDP
CMLS		✓		
Caffrey International	Tracking of fleet	✓		GDP
Dublin Airport Business Center				
IAG Cargo	Door to Door visibility	✓	Dry ice	GDP & CEIV
Worldwide Flight services		✓		GDP
Horizon Logistics Park				
CEVA	Monitor shipments 24/7	✓		GDP & CEIV
DHL Supply Chain Life Sciences	End to end traceability	✓		CEIV
Kintestu World Express	End to end traceability	✓		GDP
Fynes Logistics	Live online tracking	✓		GDP & CEIV
Kuehne + Nagel	Cargo Signal real time location	✓		GDP & CEIV
Expeditors	Cargo Signal real time location	✓		GDP & CEIV



STAKEHOLDER COLLABORATION
FOR COMPLETE SUPPLY CHAIN
VISIBILITY



JOINT CEIV TRAINING TO ENSURE
PROCESS UNIFORMITY AND TO
FACILITATE KNOWLEDGE SHARING



CERTIFY TO SIGNAL
CAPABILITIES

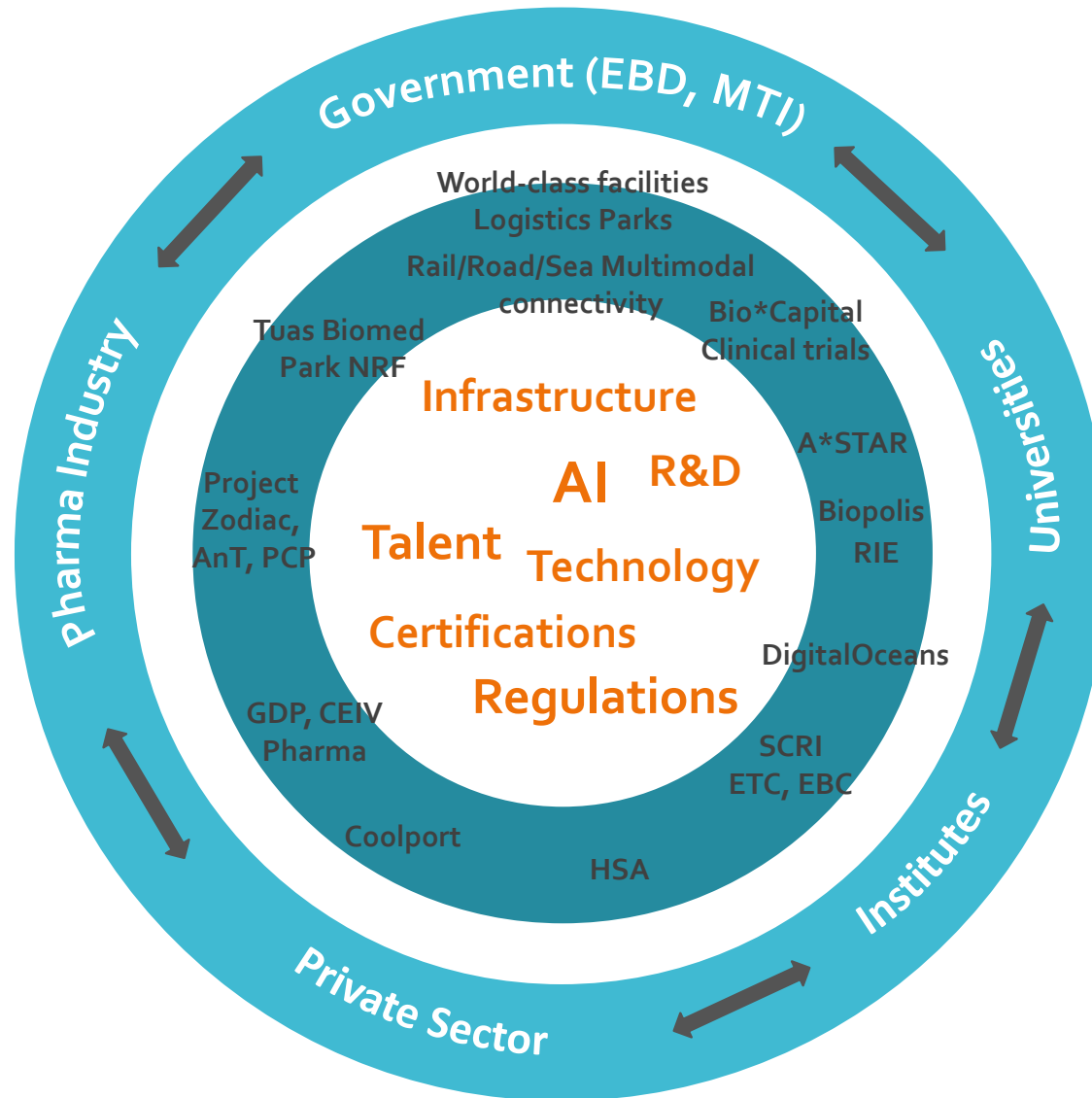


STAY CURRENT WITH TECHNOLOGY
TRENDS THROUGH INDUSTRY
MEMBERSHIPS, EVENTS

Recommendations - Training & Certification

Singapore temperature-controlled Ecosystem

- Multi stakeholder collaboration creates innovative pharmaceutical hub



#2 Market Pharma Logistics Capabilities

Insufficient advertising of existing pharma logistics assets; fragmented information

Urgent need to capitalize on global pharma logistics growth

Benchmarked airports marketing pharma hubs

Marketing Lessons From Miami, Brussels, and Schiphol Airports



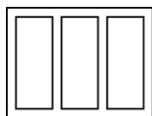
Updated **cargo specific** user-friendly **website**



Cargo specific data & statistics



Articles & newsletters highlighting advancements in **logistics competencies**



Dedicated **downloadable pharma brochure** with capacity details



Collaborations & Certifications with pharma cold supply chain stakeholders (3PLs, FF, shippers)



Contact details for further information

San Juan (SJU) International Airport

No mention of cargo
competencies!



Pasajeros	Transportación	Tiendas	Sobre Nosotros	Restaurantes
Aerolíneas Agricultura Identificación Aduana Niños Equipaje Preguntas Frecuentes Servicios al Pasajero Bancos	Alquiler de Autos Estacionamiento Taxis y autobuses Cómo Llegar	Ropa y Souvenirs Libre de Impuestos	Historia Contáctanos	Avisos Públicos IROP Plan SMS PFC RFP & RFQ Derechos Civiles UCP Título VI ADA Sección 504 DBE y ACOBE Service Providers Medios Sociales Service Animal Relief Area Aerostar Confidential Safety Report Ambiental Comunicado COVID-19

Miami International Airport

- Advocating for pharmaceutical industry's best interests
- Pharma logistics assets readily accessible
- Community partnerships Marketing Foreign Trade Zone



MIA Cargo HUB | The world's largest gateway to Latin America & the Caribbean

MIA Cargo HUB» Disk of International Trade» MIA Cargo HUB

MIA Cargo HUB

Miami International Airport (MIA) is essential to Miami-Dade's trade status, as MIA's air service network, dominance in the region's stronghold markets, and overall trade infrastructure are key for bridging business in the Hemisphere.

The leader in the Americas in international freight and the world's largest gateway to Latin America & the Caribbean, MIA controls the north / south cargo flows in the Western Hemisphere. Handling 79% of all air imports and 74% of all exports from the Latin American / Caribbean region, MIA serves as the hub for distribution of perishable products, hi-tech commodities, telecommunications equipment, textiles, pharmaceuticals and industrial machinery.

Over 100 airlines at MIA contribute to the year-round, two-way cargo traffic, linking the Americas with the high growth markets in Asia, Europe, the Middle East / Gulf Region and beyond.

Exceptional infrastructure and facilitation, new runway capacity with no slot restrictions or delays, and room for growth, form just part of MIA's outstanding attributes.

Cargo HUB	Pharma HUB	Cargo Airlines	Cargo Modernization	Cargo Related Links	Current Trade Numbers
-----------	------------	----------------	---------------------	---------------------	-----------------------



Cargo

[Airport / Cargo Rankings](#) (PDF)

[Cargo Airlines](#)

[Cargo Flight Tracker](#)

[Cargo Hub Brochure](#) (PDF)

[Disk of International Trade](#)

[MIA Facts-at-a-Glance](#) (PDF)

[Publications](#)

[MIA Pharma Hub Brochure](#)

[Disk of International Trade](#)

[Asia Region Trade Stats](#)

[Europe Region Trade Stats](#)

[Latin America & Caribbean Region Trade Stats](#)

[Middle East Region Trade Stats](#)

[Resources](#)

"Foster collaboration among CEIV pharma certified airport communities around the world."

STRATEGIC AIRPORT MEMBERS



STRATEGIC PHARMA SHIPPER MEMBERS



FULL MEMBERS



Brussels International Airport

- Emphasizing cargo competencies for a pharmaceutical gateway
- Market pharma refrigerated warehouse space
- Highlighting community-based certification



LOCAL COOPERATION WITHIN BRUCARGO PHARMA HUB PROJECT GROUP



WHO?



HOW?

- Direct dialog and local workshops with manufacturers.
- Continuous local pharma working group with all involved stakeholders.



TARGET?

- Mapping of improvements
- Implementation of cargo community innovations
- Continuous quality improvements
- Performance evaluation of pharma KPI's

www.brusselsairport.be | brucargo@brusselsairport.be



THE PREFERRED PHARMA GATEWAY



Biggest number of CEIV pharma certified companies

Biggest concentration of dedicated pharma infrastructure

Controlled temperature through the entire cool chain at the airport

Excellent geographic location for pharma consolidation and storage

Schiphol International Airport

- Highlighting cross-industry collaboration to achieve excellence in reliable end-to-end air transportation for pharmaceutical shippers



Excellent connectivity

Schiphol is Europe's best-connected airport, with the most direct air destinations.



Cooperative customs

A close relationship with customs provides for a smooth clearance process.



Quality ground operations

Supply chain innovations support the high quality and efficiency of our ground handling operations.





CONDUCT STUDY TO UNVEIL WHITE
SPACE MARKETING OPPORTUNITIES







CREATE MARKETING PRODUCT TO
ADVERTISE TEMPERATURE-
CONTROLLED CAPABILITIES



REVAMP SJU WEB TO MARKET
CARGO CAPABILITIES

Recommendations - Marketing

BENCHMARKING SCORE CARD

Categories	Puerto Rico	Singapore	Ireland	Amsterdam-AMS	U.S.-MIA	Belgium-BRU
Cold chain ecosystem	L	H	M	H	M/H	M/H
Cold chain airport capacity	L	H	M	M	M/H	M/H
Temperature range	M	H	H	M	M/H	H
Training	M	H	M	H	H	H
Marketing Quality	L	H	L/M	H	H	H
CEIV- airport certification	N/A		N/A			

Low

Low/Medium

Medium

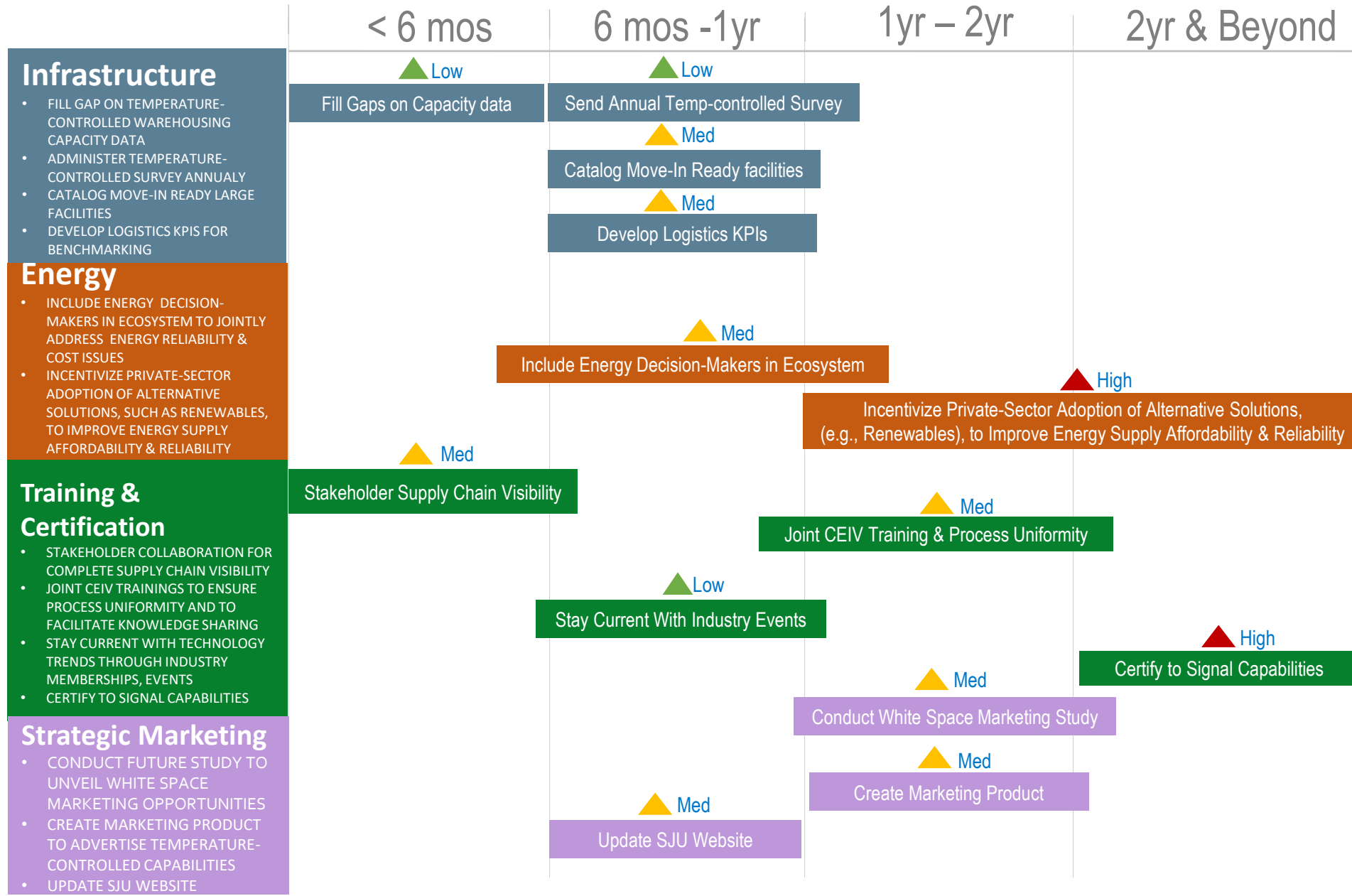
Medium/High

High

IMPLEMENTATION PLAN

Resource Intensity

Low  Med  High 



Summary

Puerto Rico must build and market a robust pharma temperature-controlled ecosystem to 1) maintain competitiveness as a top pharma destination and 2) remain competitive in the long run

To build and market Puerto Rico's pharma temperature-controlled ecosystem, we recommend addressing gaps in:

- A. Infrastructure
- B. Energy
- C. Training & Certifications

Ecosystem should be supported with marketing of pharma logistics assets:

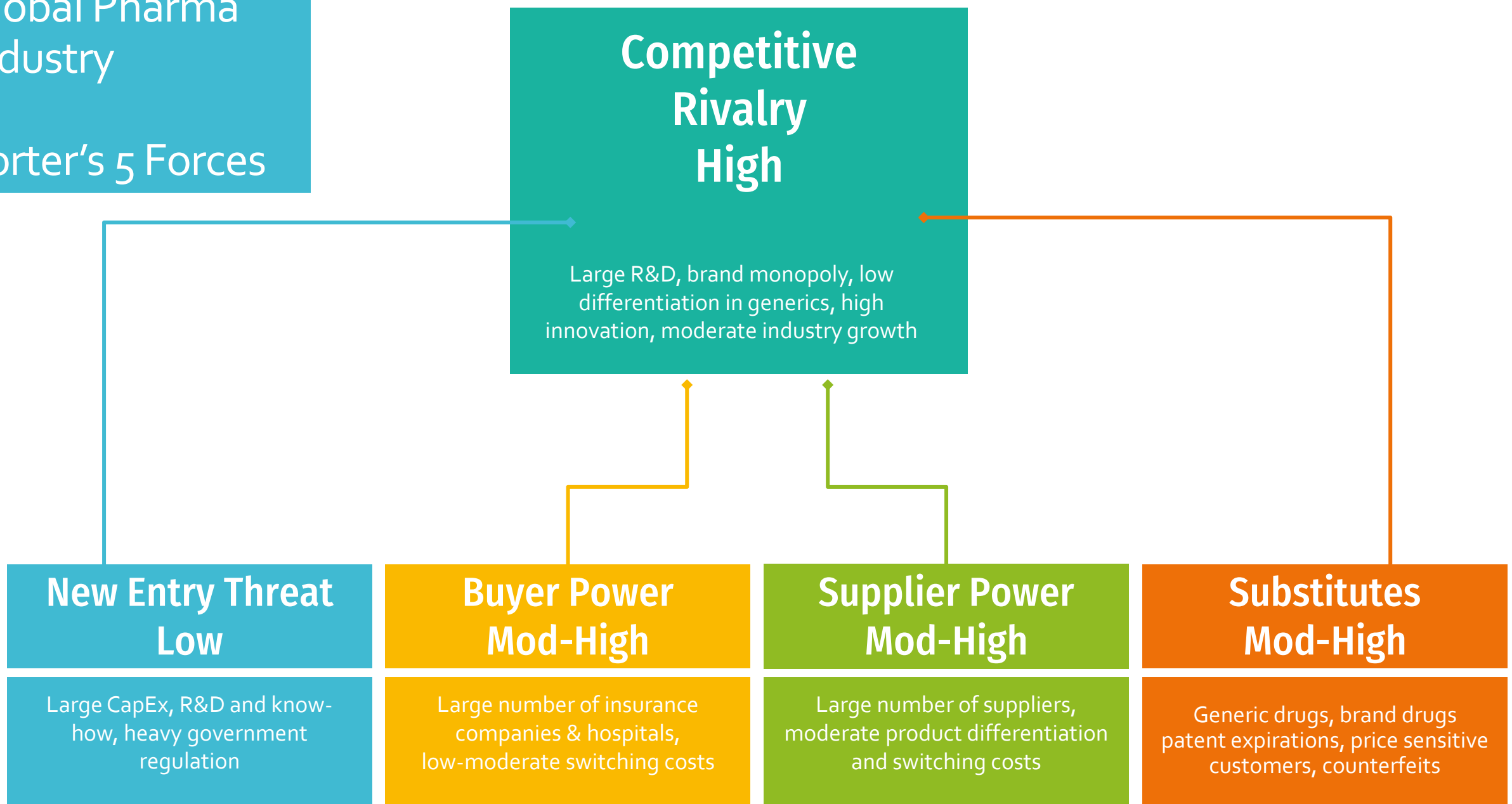
- A. Update SJU website with cargo storage and handling capabilities
- B. Create marketing product to highlight PR's temperature-controlled pharma competencies
- C. Conduct future study to unveil white space marketing opportunities to differentiate against top global jurisdictions

Appendix

- SLIDE 67: Global Pharma Industry Porter's 5 Forces
- SLIDE 68: Global Pharma Industry Trends
- SLIDE 69: Global Pharma Regulatory Agencies
- SLIDES 70-77: Global Pharma Temperature-Controlled Logistics Market
- SLIDE 78: Puerto Rico Economic Overview
- SLIDE 79: Puerto Rico Top Export Destinations & Import Sources
- SLIDE 80: Puerto Rico Pharma Industry Corridor
- SLIDE 81: Puerto Rico SWOT
- SLIDES 82-86: Puerto Rico Pharma Trade
- SLIDES 87-88: Puerto Rico Electricity Reliability Report
- SLIDES 89-92: Puerto Rico Detailed Stakeholder Interviews
- SLIDE 93: Global Logistics Cost Trends
- SLIDE 94-96: Singapore Pharma Industry
- SLIDE 97: Singapore SWOT
- SLIDE 98: Singapore Pharma Industry Stakeholders
- SLIDES 99-101: Ireland Pharma Industry
- SLIDE 102: Ireland SWOT
- SLIDE 103: Ireland Pharma Industry Stakeholders

Global Pharma Industry

Porter's 5 Forces



Global Industry Trends



01

Supply Chain

Resilience, risk mitigation, reshoring

02

Manufacturing

Cost reduction efforts, growth in generic drug market, small batch precision medicine

03

Clinical Innovation

Biologics, gene & cell therapy, clinical trials, R&D

04

Technological Integration

Digitalization, IoT, integrated management systems, automation, AI

Global Pharma Regulatory Agencies

Global

- The International Council for Harmonization of Technical Requirements for Pharmaceuticals for Human Use (ICH)

U.S.

- FDA - Current Good Manufacturing Practice (CGMP) Regulations
- Federal Food, Drug and Cosmetic Act s the basic food and drug law of the U.S.
- 21 CFR

EU

- European Medicines Agency (EMA)
- ~ 50 regulatory authorities from the 31 EEA countries (28 EU Member States plus Iceland, Liechtenstein and Norway)
- GCP, GMP, GDP, GVP

ASEAN

- Association of Southeast Asian Nations (ASEAN)
- many ASEAN regulatory guidelines are harmonized with ICH and EU guidelines

Global Pharma Temperature - Controlled Logistics Market

- Overview
- Segments & Value Chain
- 5 Forces Industry Analysis
- Drivers, Challenges, Trends
- Main Players



Market Overview

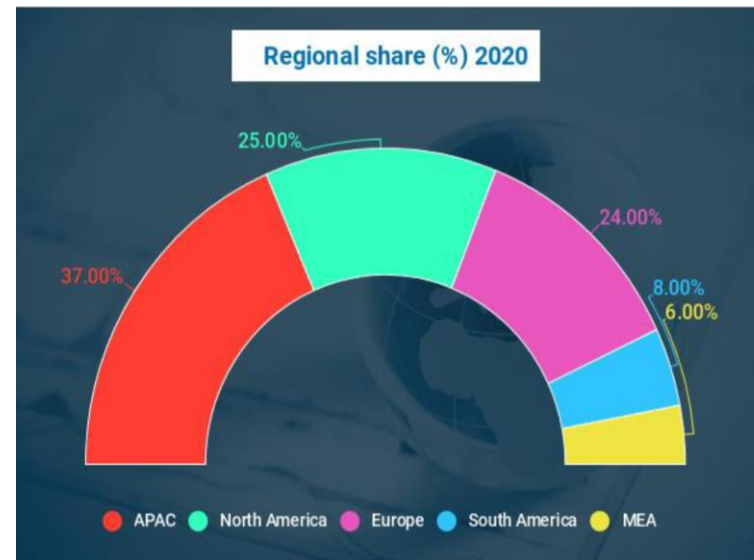
for Pharmaceutical Industry

\$17b Market in 2020
\$21b Forecast for 2024
5.4% CAGR

Temperature controlled uninterrupted series of transportation, storage, and distribution of products including trucking, shipping, warehousing, and parcel delivery

- Cold chain logistics via **air transportation is the fastest** way of shipping pharmaceutical products with minimal damage
- **Seaborne transportation is increasing** due to advances in technology and reduced costs

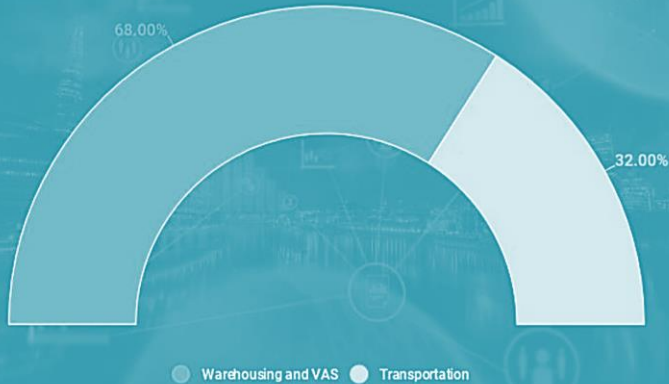
Market by region



1	20.00%-22.00%	US
2	13.50%-14.50%	China
3	5.50%-6.50%	Germany
4	4.75%-5.35%	UK

Segments & Value Chain

Segment share (%) 2020



Warehousing (68%)

Storage of finished and semi-finished goods in a storehouse or at a distribution center. The warehousing activity is capital-intensive and critical in the supply chain. Services include loading and unloading, and inventory management tools.

Transportation (32%)

The movement of products through the air, water, and land modes of transport. Asset tracking systems (GPS), temperature data loggers, and real-time environmental monitoring systems, are used to improve transportation efficiency.

Value Chain

Fragmented market, with multiple layers in the supply chain



Drivers



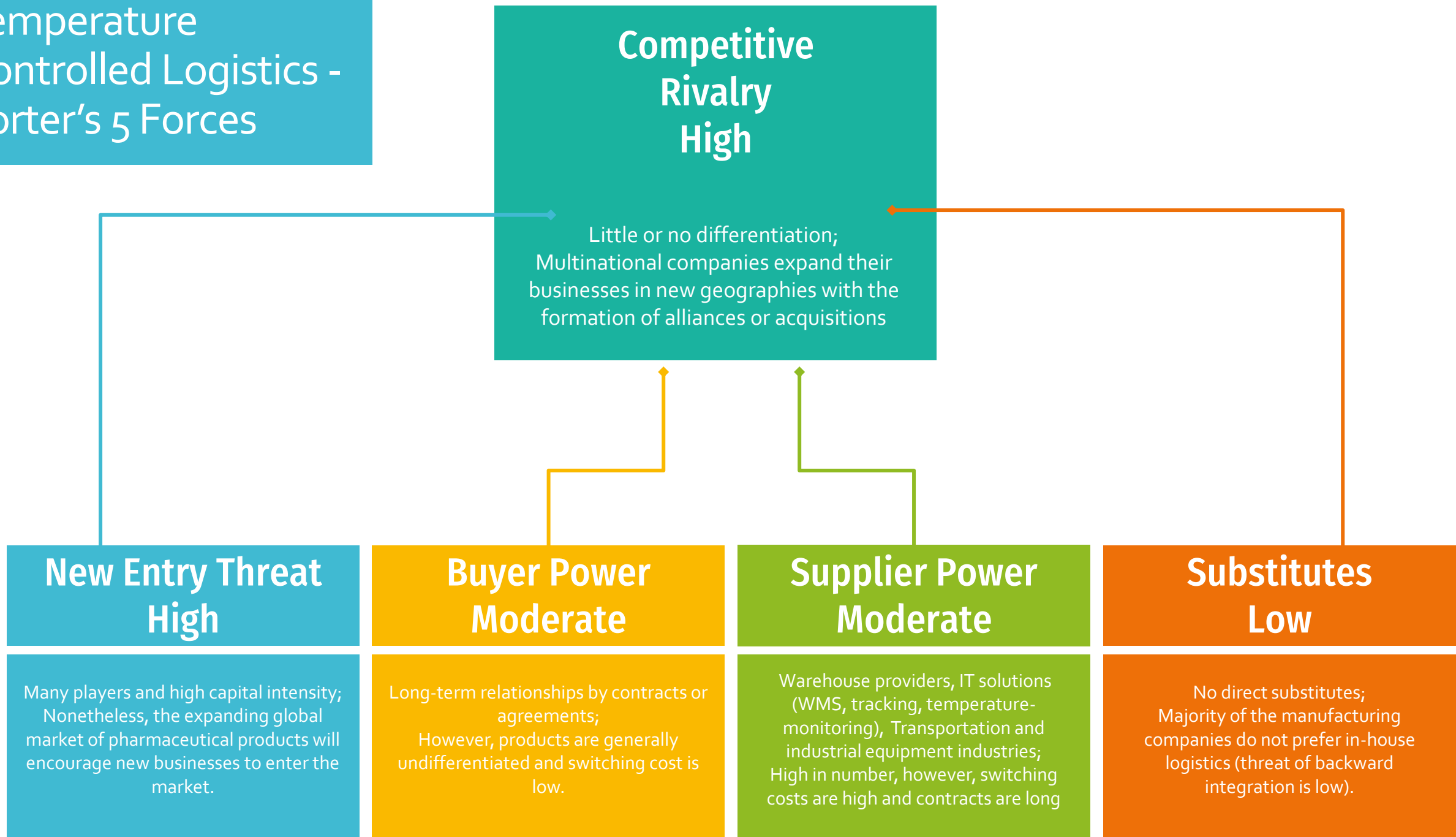
Growth drivers

The cold chain industry is driven by rising global demand for pharmaceutical products due to:

1. Growing demand for the latest **high-value biopharma products (biologics & biosimilars), gene-based therapies, clinical trials** which are highly temperature-sensitive
2. Initiatives to **reduce communicable and infectious diseases** (malaria, AIDS) by World Health Org, governmental, and non-governmental organizations
3. Rising demand to **combat chronic and lifestyle-related diseases** especially due to growing elderly population

By 2022, 30 of the top 50 biopharma products will require cold chain

Temperature Controlled Logistics - Porter's 5 Forces



Challenges

Challenges

1. Securing strategic warehousing near the production facility and ports
2. High energy consumption and reliability:
 - 15% of the total operating cost
 - 55% of warehousing cost
3. Stringent government regulations to adopt better safety measures
4. Excursions caused by:
 - a. Inconsistent logistics infrastructure
 - b. Old-fashioned technology
 - c. Lack of trained personnel



Trends

1. Consolidation of global market, growth by acquisition of local players
 2. Increased use of IoT and technological solutions
- Chain **monitoring systems** with real-time environmental data monitoring, condition & location monitoring, constant connectivity and analytics
 - **Shared end-to-end visibility** of inventory, location tracking, environmental conditions
 - **Automated storage/retrieval systems** will make warehousing operations lean, resulting in cost savings. Storage of the same volume of pharmaceuticals, warehouses equipped with AS/RS use 40% less space than conventional warehouses



Global Main Players

- Numerous international and regional vendors
- M&A allow companies to deliver services at all end-to-end points
- Revenue from the **global cold chain market for pharmaceuticals** contributes to overall revenues but **is not a key revenue stream for the companies**

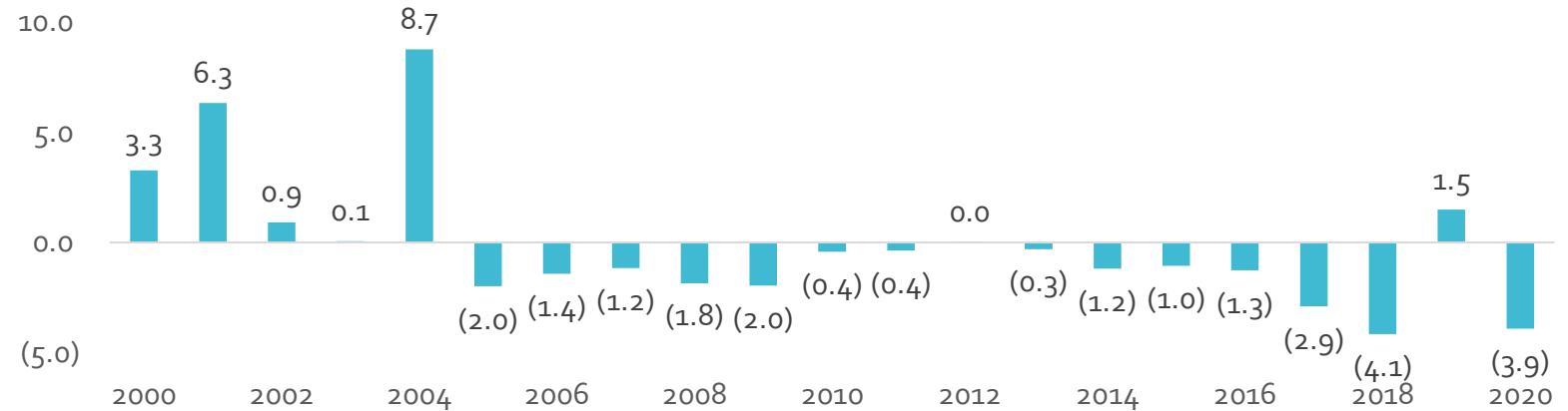
1. Agility Public Warehousing Company KSCP	11. Kerry Logistics Network Ltd.
2. AGRO Merchants Group	12. Kuehne + Nagel International AG
3. Air Canada	13. Lineage Logistics LLC
4. Burris Logistics	14. Nichirei Corp.
5. Cold Chain Technologies LLC	15. Orient Overseas International Ltd.
6. Deutsche Post DHL Group	16. PCI Pharma Services
7. FedEx Corp.	17. SCG Logistics Management Co. Ltd.
8. Helapet Ltd.	18. United Parcel Service Inc.
9. Igloo thermo Logistics Ltd.	19. Versa Cold Logistics Services
10. JWD InfoLogistics Public Co. Ltd.	20. XPO Logistics Inc.

Puerto Rico Economic Growth & Population

- Shrinking population
complicates prolonged
recession dynamics

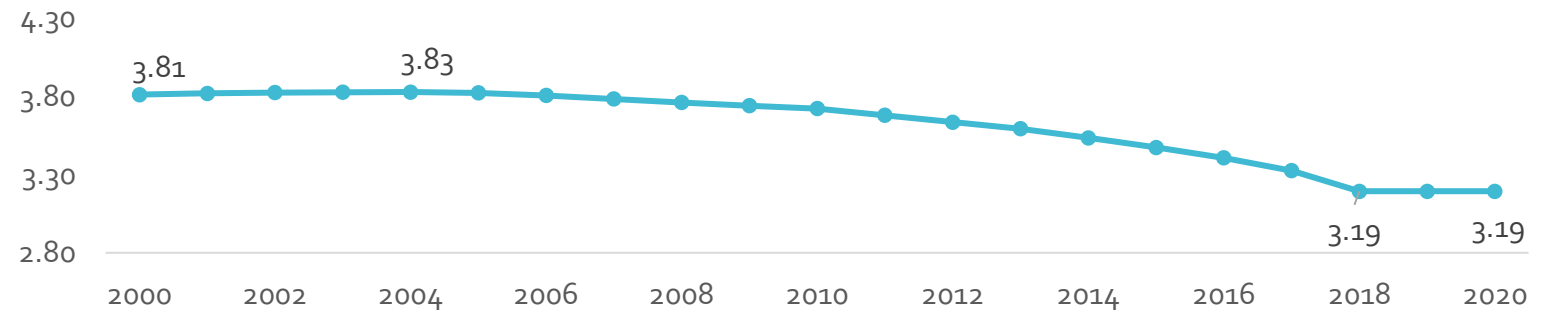
Real GDP Growth

(% change, year over year)



Population

(Millions)



Source: Word Bank.

Puerto Rico's Top Export & Import Destinations

Total Exports	62,308,296,928	100%
Top 20	61,232,015,421	98%
Top 10	59,394,432,677	95%

Country	Exports	
United States	47,266,271,574	75.9%
Netherlands	2,644,917,886	4.2%
Italy	1,691,560,870	2.7%
Germany	1,665,268,091	2.7%
Spain	1,541,359,433	2.5%
Japan	1,432,257,066	2.3%
Belgium	1,060,781,714	1.7%
Austria	985,967,649	1.6%
China	655,746,325	1.1%
France	450,302,069	0.7%
Dominican Republic	396,257,804	0.6%
United Kingdom	240,421,089	0.4%
Virgin Islands	236,865,276	0.4%
Mexico	222,926,059	0.4%
Brazil	170,487,894	0.3%
Ireland	170,200,893	0.3%
South Korea	127,070,742	0.2%
Canada	118,243,146	0.2%
Argentina	93,139,116	0.1%
Singapore	61,970,725	0.1%

Total Imports	44,355,215,594	100%
Top 20	42,279,307,881	95%
Top 10	38,504,420,692	87%

Country	Imports	
United States	22,642,507,335	51.0%
Ireland	8,447,211,394	19.0%
Switzerland	1,740,179,881	3.9%
Singapore	1,360,561,398	3.1%
Brazil	1,014,896,206	2.3%
China	721,740,394	1.6%
Colombia	689,978,250	1.6%
Canada	684,444,834	1.5%
Mexico	602,362,458	1.4%
South Korea	600,538,542	1.4%
Japan	547,179,987	1.2%
Russia	469,041,978	1.1%
Dominican Republic	461,896,318	1.0%
Italy	458,844,844	1.0%
Germany	383,175,946	0.9%
Trinidad and Tobago	366,576,490	0.8%
Netherlands	337,777,702	0.8%
Belgium	302,851,480	0.7%
Lithuania	258,183,574	0.6%
India	189,358,870	0.4%

Source: Junta de Planificación de Puerto Rico. Puerto Rico's External Trade 2020 Tables.

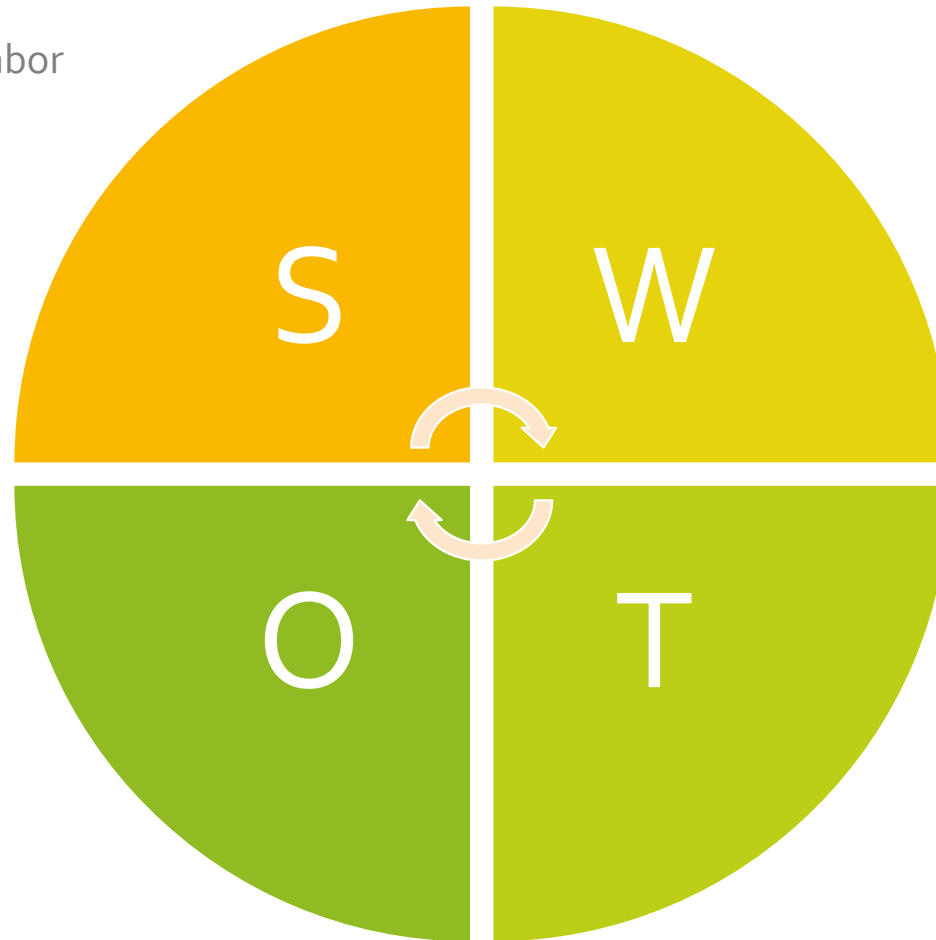


Puerto Rico Pharma Corridors

Puerto Rico Pharma Industry

- Strong manufacturing capabilities
- Skilled, productive and low-cost labor
- FDA regulations and local SOPs
- Robust IP protection
- Strategic geographic location
- Foreign Trade Zone designation
- Local and federal incentives
- Top 8 pharma exporter

- Supply chain reshoring trend
- Clinical trials, novel therapy R&D
- Temperature-controlled logistics
- Cargo capacity
- Stakeholder collaborations
- LATAM expansion

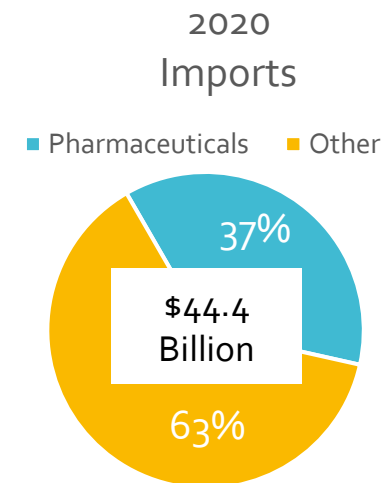
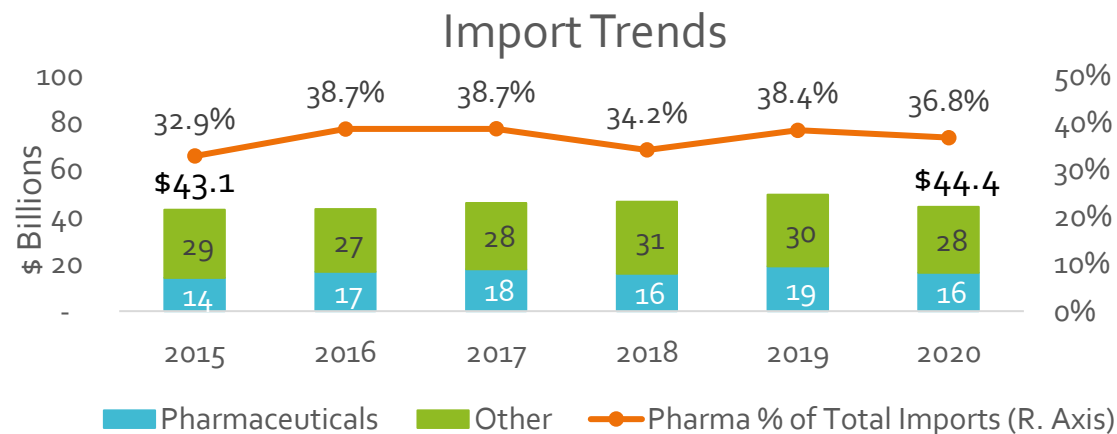
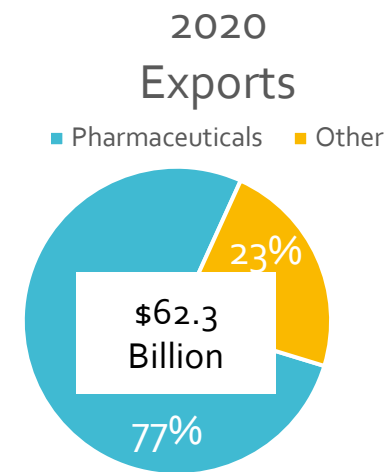
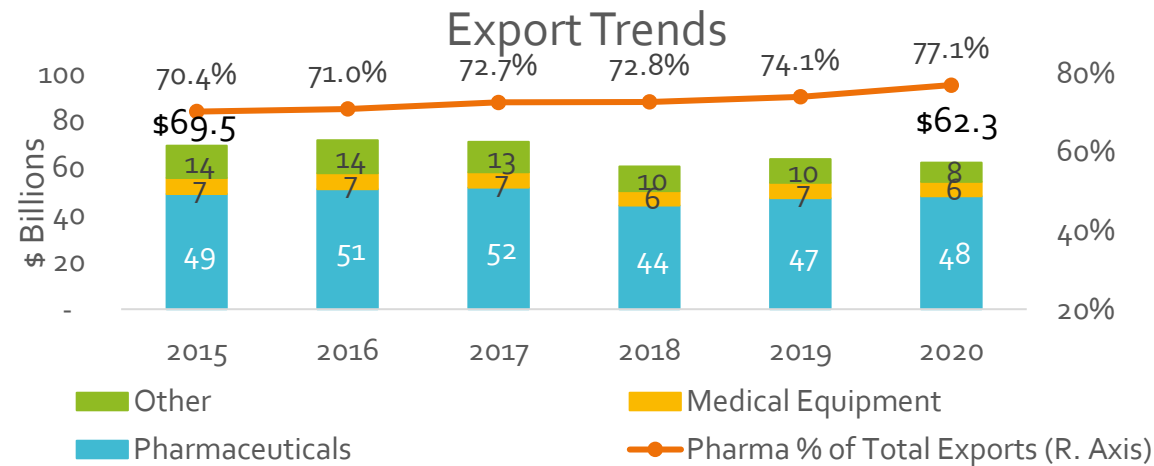


- Declining pharma contribution to GDP
- Energy reliability / high costs
- Small domestic market
- Low R&D intensity
- Fiscal healthcare spend cuts
- Inefficient Intermodal capacity (e.g. rail, roads)
- Limited large move-in facilities

- Declining population growth / ageing demographics
- Skilled labor migration
- Rising demand for generics
- Rival state of the art manufacturing jurisdictions
- Regulated drug pricing

Puerto Rico Trade Trends

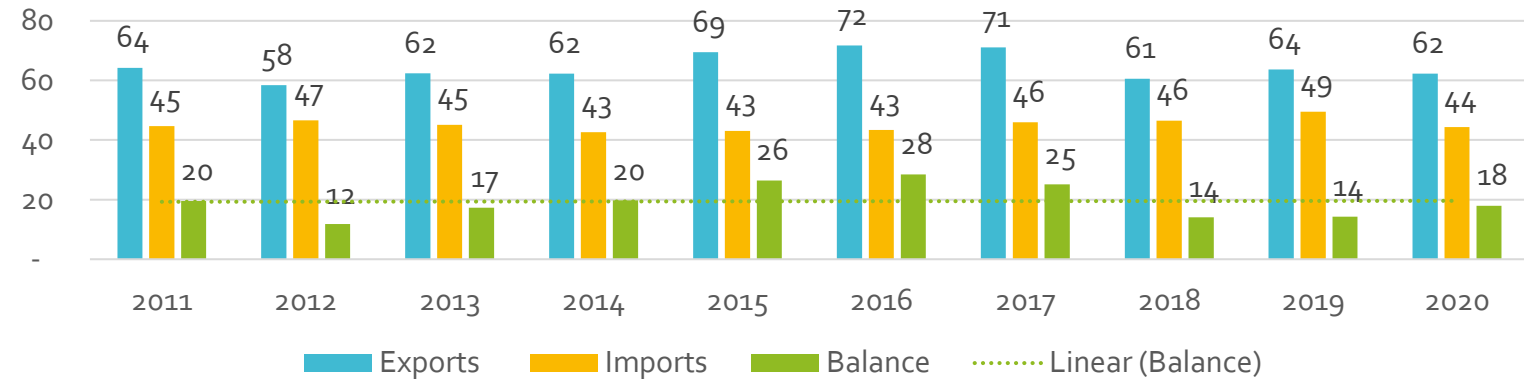
-Total PR exports on the rise since 2018, led by pharma which represent 74% of total exports and primarily go to mainland U.S.



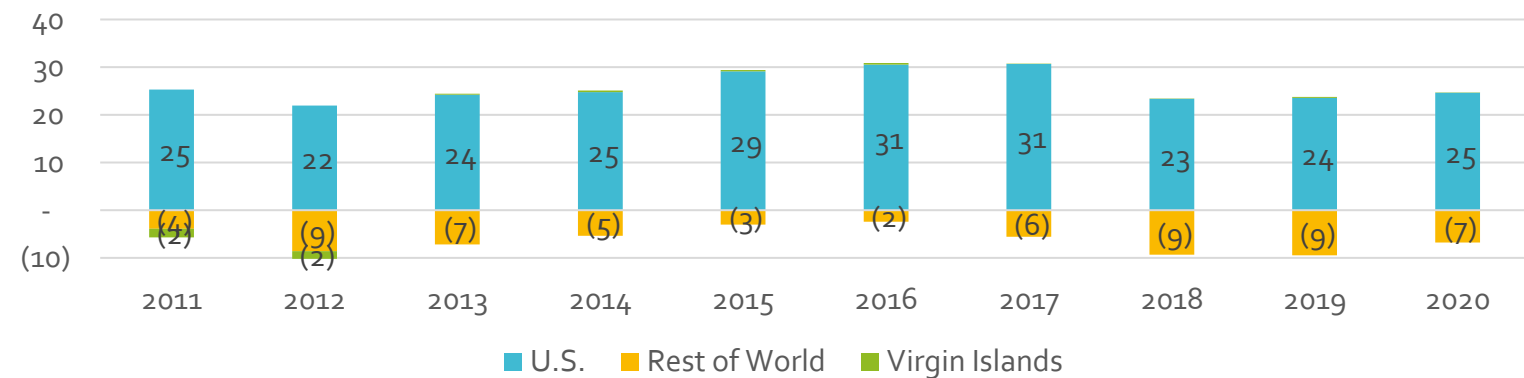
Trade Balance Trends

- U.S. is major contributor of PR's trade surplus

Trade Balance, \$ Billions



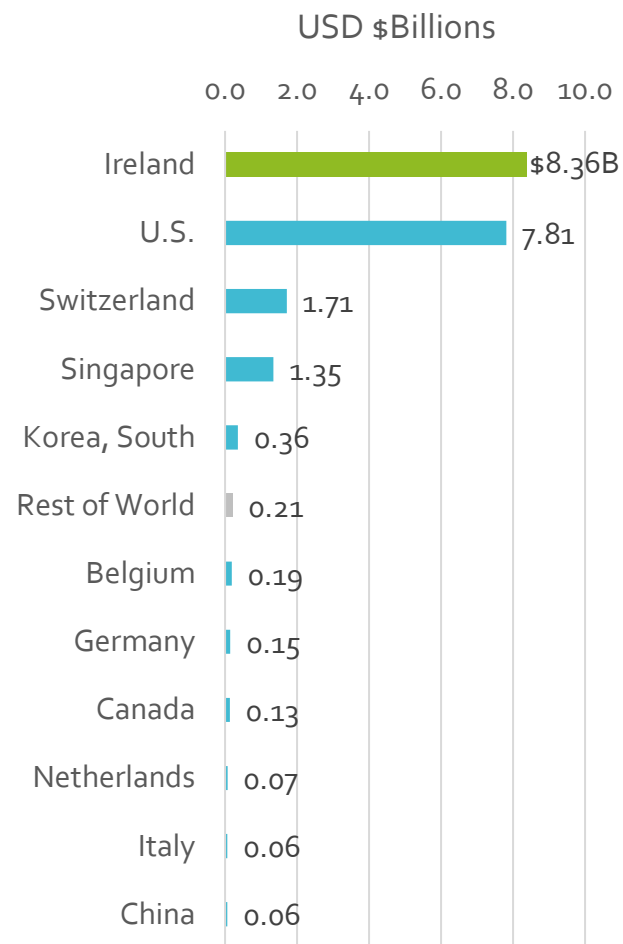
Trade Balance by Source, \$ Billions



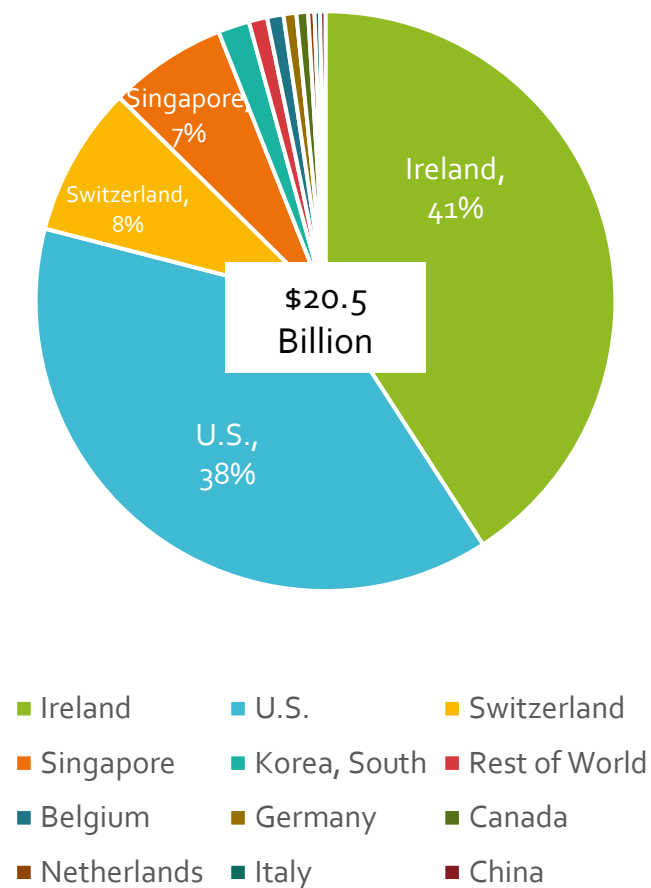
Source: Puerto Rico Planning Board, Program of Economic and Social Planning, Subprogram of Economic Analysis – Statistical Appendix of the Economic Report to the Governor 2020. Table 25.

Puerto Rico Pharmaceutical Imports

Top Import Destinations

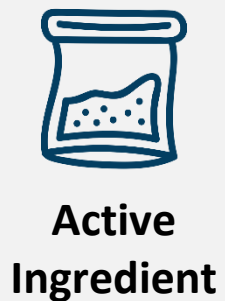
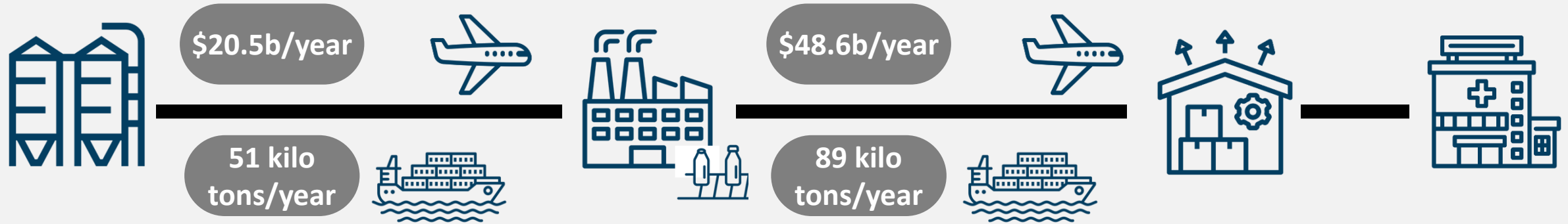


Import Share



Source: Junta de Planificación de Puerto Rico. Puerto Rico's External Trade 2020 Tables. EMAP team calculations.
Pharmaceutical Products & Organic Chemicals trade include HS29 & HS30.

PUERTO RICO PHARMA IMPORTS/EXPORTS



Puerto Rico Pharmaceutical Trade by Value & Volume

Pharmaceutical Products + Organic Chemicals				
	<u>Exports</u>		<u>Volume</u>	
	\$		KG	
U.S.	36,118,914,280	74%	54,131,369	61%
Virgin Islands	26,712,448	0%	259,193	0%
Rest of World	12,463,604,322	26%	34,955,569	39%
Total	48,609,231,050	100%	89,346,130	100%
	<u>Imports</u>		<u>Volume</u>	
	\$		KG	
U.S.	7,808,718,794	38%	35,848,835	70%
Virgin Islands	-	0%	0	
Rest of World	12,649,359,971	62%	15,048,958	30%
Total	20,458,078,765	100%	50,897,793	100%
Trade Balance	28,151,152,285		38,448,337	
Total volume			140,243,924	
U.S.			89,980,203	64%
Virgin Islands			259,193	0%
Rest of World			50,004,527	36%

Source: Junta de Planificación de Puerto Rico. Puerto Rico's External Trade 2020 Tables. EMAP team calculations. Pharmaceutical Products & Organic Chemicals trade include HS29 & HS30.

Electricity Reliability

DOE Report:

Energy Resilience Solutions for the PR Grid (2018)

- PREPA's SAIFI was calculated at 11.61, which is an order of magnitude higher than the U.S. average
- PREPA exceeded its SAIDI goal of 10 hours by 60%
- PREPA's CAIDI was 180 minutes, up from 140 in 2013

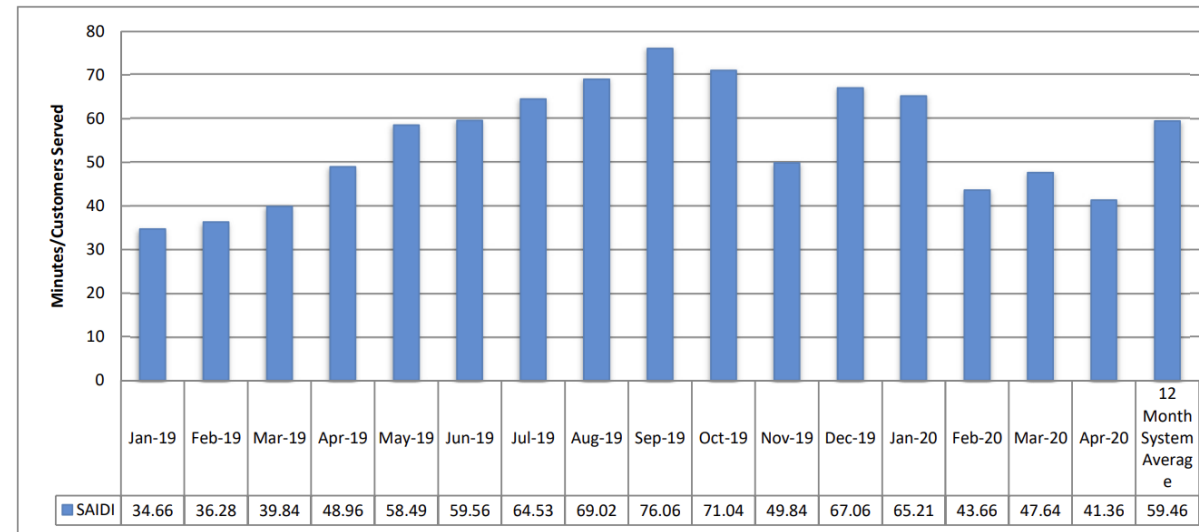
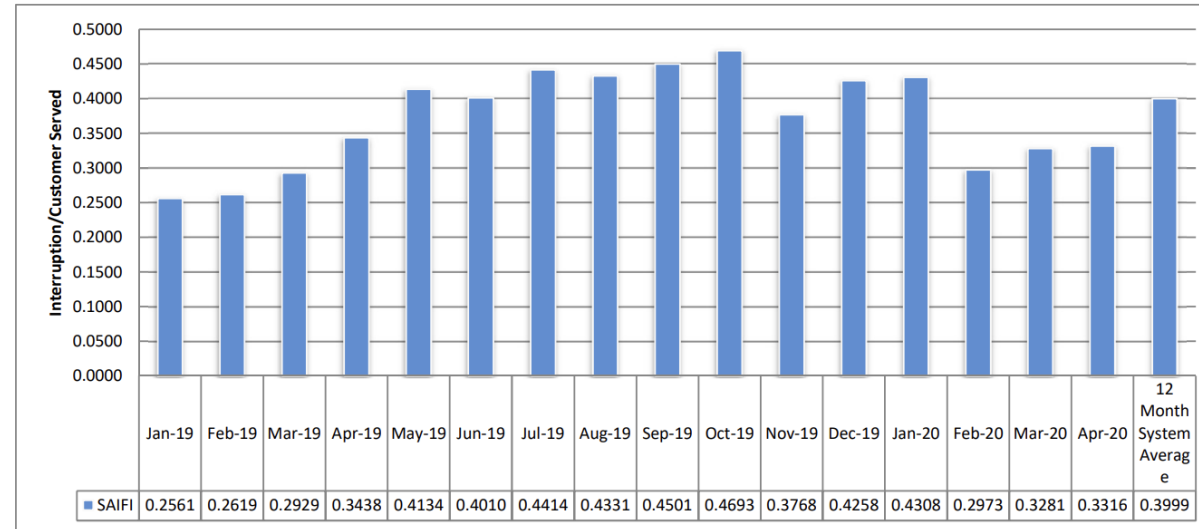
System Average Interruption Duration Index (SAIDI)

System Average Interruption Frequency Index (SAIFI)

Customer Average Interruption Duration Index (CAIDI)



Electricity Reliability Report Data



Stakeholder Interviews

Pharmaceutical Interviews	Strength / Opportunity	Feedback
Interview #1	Strength	reliable Quality & Supply, good at regulatory compliance
	Opportunity	energy cost, cost of cold chain materials (blankets), too many stops, no R&D
Interview #2	Strength	experience moving product at diff stages (raw materials -> finished goods and in different markets
	Opportunity	export declaration lengthy process, cargo availability and delays, infrastructure, cost of doing business in PR, ocean rates
Interview #3	Strength	we produce and ship key drugs around the world to Asia, Europe, USA and are seeing growth in some volumes
	Opportunity	global supply chain issue, everything is getting constrained, reduced frequency of carries to PR, surge pricing, costs
Interview #4	Strength	talent in Puerto Rico is solid, our product can reach the U.S. quickly and other international places
	Opportunity	moving items through China due to shipping lane availability and storage capacity, lab consistency

Stakeholder Interviews

Non-Pharmaceutical Interviews	Strength / Opportunity	Feedback
Interviewer #5	Strength	clinical Trials & manufacturing, 90% of seeds grown in PR are used over the world, largest supplier of Spanish researchers/ educators/ scientists/ workers
	Opportunity	international transportation, manufacture effectiveness, silos (who & how to target), airport infrastructure, refueling capacity, Aguadilla airport
Interviewer #6	Strength	communications systems, KPI ship turn around
	Opportunity	cost of cold chain materials (blankets), weak infrastructure outside of terminal
Interviewer #7	Strength	energy redundancy with generators (+/-), warehouse management systems, knowledge/skill of local workforce
	Opportunity	unreliable energy, cost of energy, release at port & customs with lengthy manual paperwork forms

Stakeholder Interviews

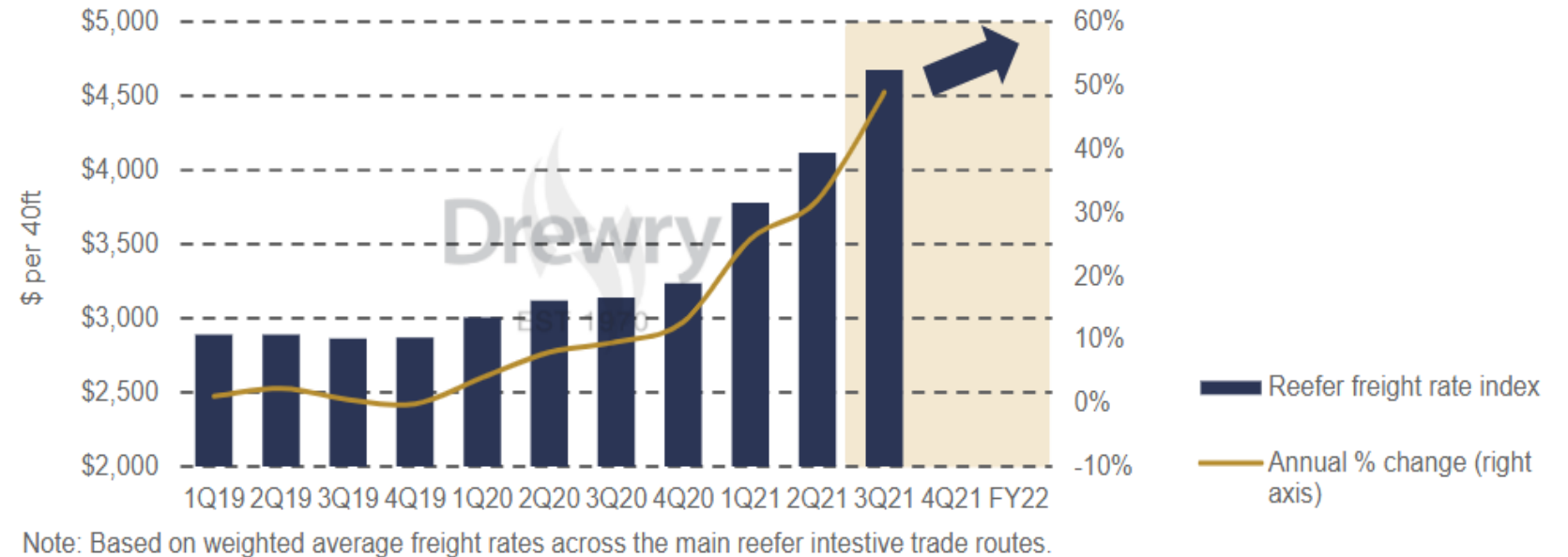
Non-Pharmaceutical Interviews	Strength / Opportunity	Feedback
Interviewer #8	Strength	robust infrastructure of industrial park, companies don't pay real estate tax if it's a PRIDCO building, rental price is \$6/SqFt for manufacturing vs \$12/SqFt private sector
	Opportunity	~21% of buildings not move-in-ready, need repairs/updates, need access to more relief funds, need more lobbying for better requirements in PR
Interviewer #9	Strength	3PL logistics are all documented & certified, opportunity as U.S. is short over 2 million SqFt of temp controlled space
	Opportunity	unreliable energy, cost of energy + redundancy, cost of bldg materials is 3X what it was, facility availability (demand > capacity), time for compliance/certification of retrofitting ~1yr
Interviewer #10	Strength	we have a cold in-transit storage / freight forwarder at airport that is expanding, + CEIV certified, pharma needs more 15-25 storage capacity (~4000 skits)
	Opportunity	very expensive cost (several million \$) to build coolers with redundancy

Stakeholder Interviews

Non-Pharmaceutical Interviews	Strength / Opportunity	Feedback
Interviewer #11	Strength	facilities highly automated and have software to comply with regulations,
	Opportunity	weak infrastructure outside of facilities, gov changes every 4 years so we lose continuity / progress, is a challenge when your industry is highly advanced/technological; but gov is not
Interviewer #12	Strength	given current political situation in other jurisdictions there is opportunity for increase in pharma & bio in PR, +our ability to educate and train talent, department of transportation initiative April 2020,
	Opportunity	PR has been in a depression for 16 years, Our university creates highly talented work force that leaves the island because there are no opportunities to grow, practice and develop, < 50% of the plants on the island participate in logistics meetings so difficult to get accurate data of in/out island

Global Reefer Container Freight Trends

Drewry Global Reefer Container Freight Rate Index



- Cargo demand growth and supply chain disruptions contributing to reefer shortages and rising freight rates

Source: <https://www.drewry.co.uk/news/reefer-con>

Singapore Pharmaceutical Industry

Pharmaceutical & Medical Device Companies

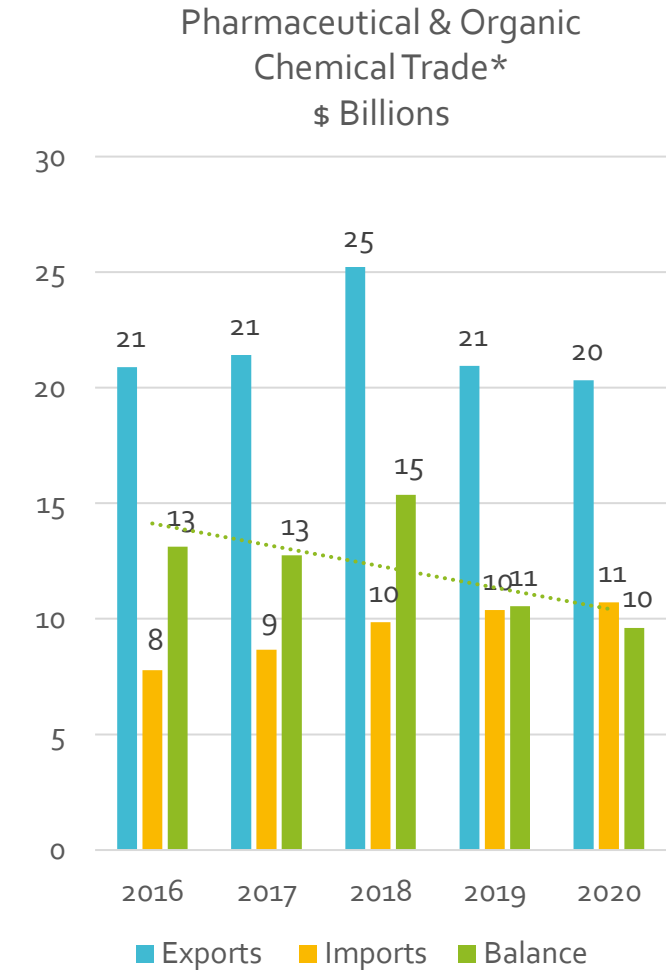


The list of companies are not exhaustive
Accurate as of 2019
Source: EDB

Singapore Pharma Market Outlook

Pharmaceutical & Organic Chemicals Trade Balance

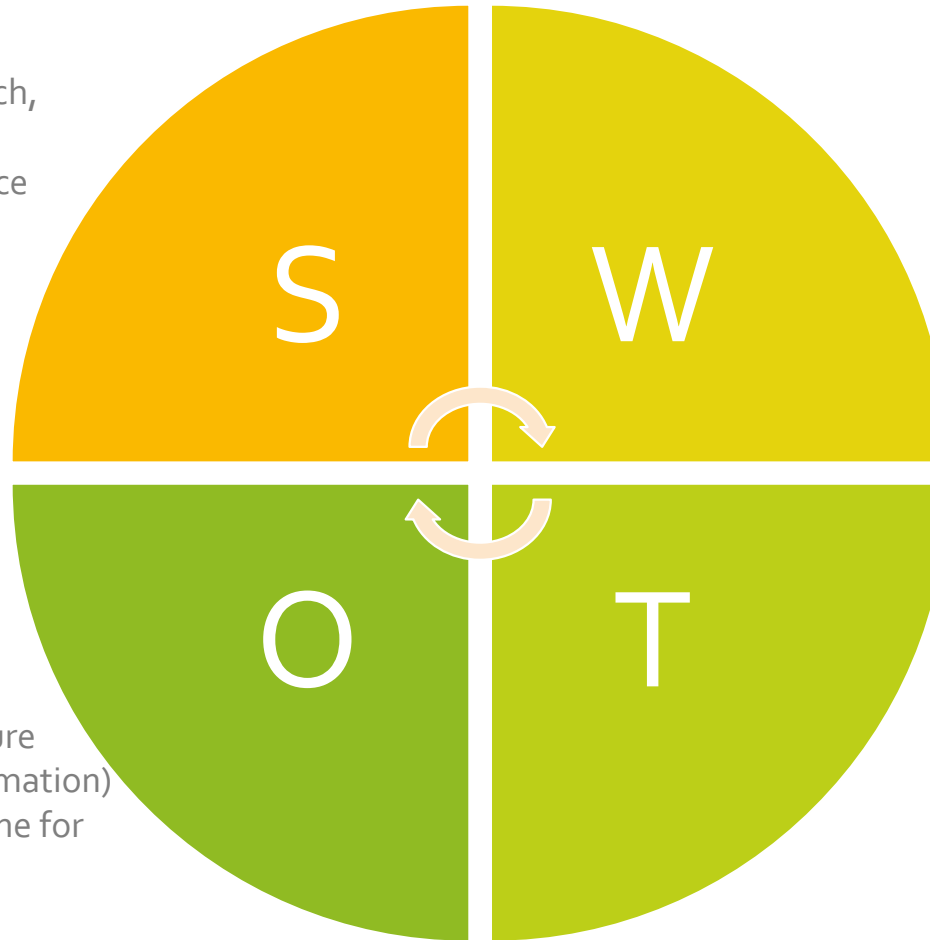
- Pharmaceutical production market \$29.3
 - Forecast to grow at a CAGR of 4.9% between 2021-2026 (Euromonitor)
- Singapore's pharmaceutical and organic chemical exports account for ~2% of global exports
 - \$20 bn exports; ranks #15 globally
 - \$10 bn trade surplus and positioned for continued growth



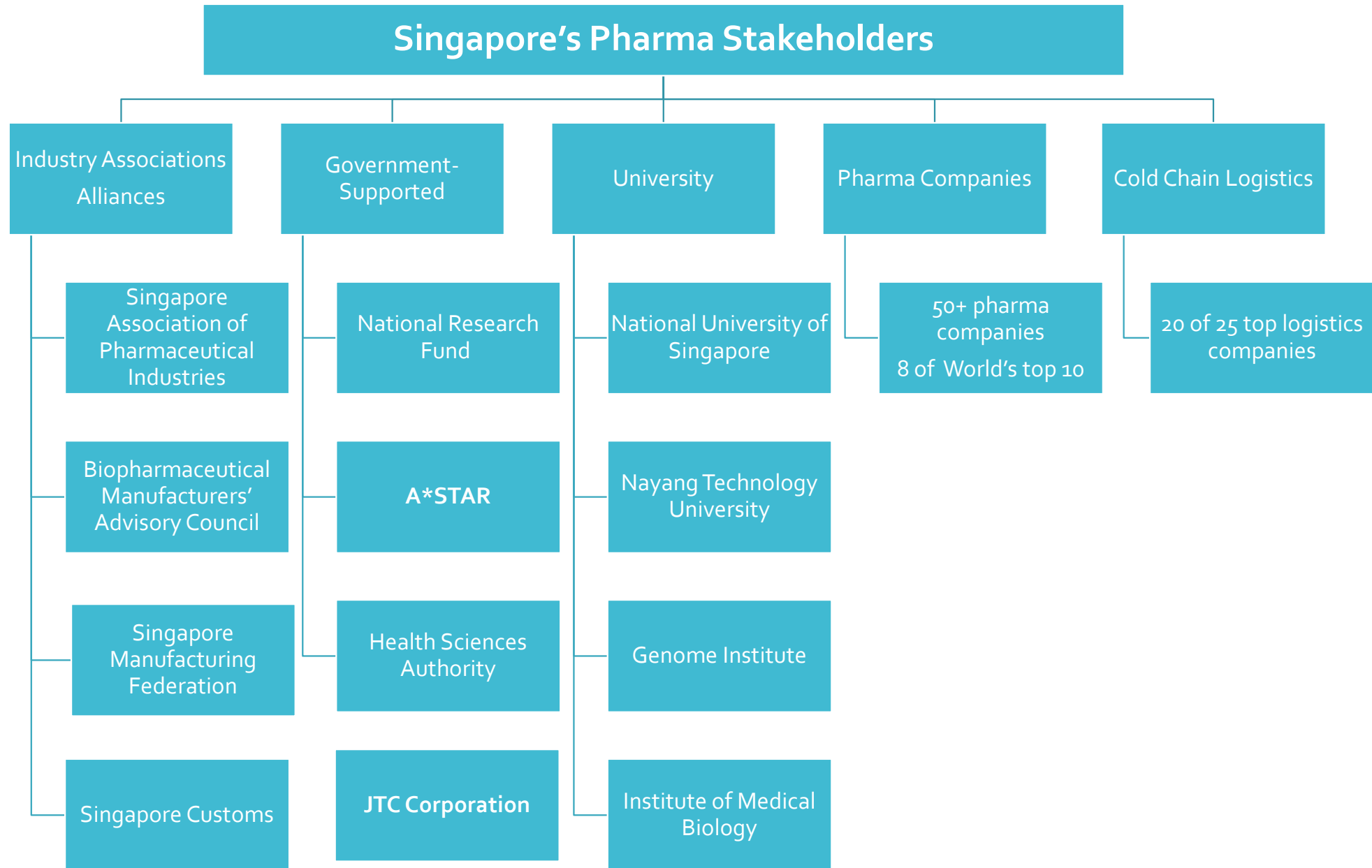
Source: UNCTAD; includes HS29 & HS30 commodities only

Singapore Pharma Industry

- Strong manufacturing hub
 - Availability of ready-built facilities
 - Large government spending on research, innovation and education
 - Strong skilled pharmaceutical workforce
 - ASEAN logistic hub
 - Hosts top 20 of 25 logistics companies
 - Robust technological advancements
 - Strong regulations
 - Stable political landscape
-
- Investment to gain market share in neighboring countries as regional hub
 - Global pharmaceutical exports growth
 - Lead a role in trade and commerce as part of China's Belt and Road Initiative
 - Advancing pharmaceutical infrastructure with cutting edge expertise (e.g., automation)
 - Establishing a lead in precision medicine for Asian genotypes



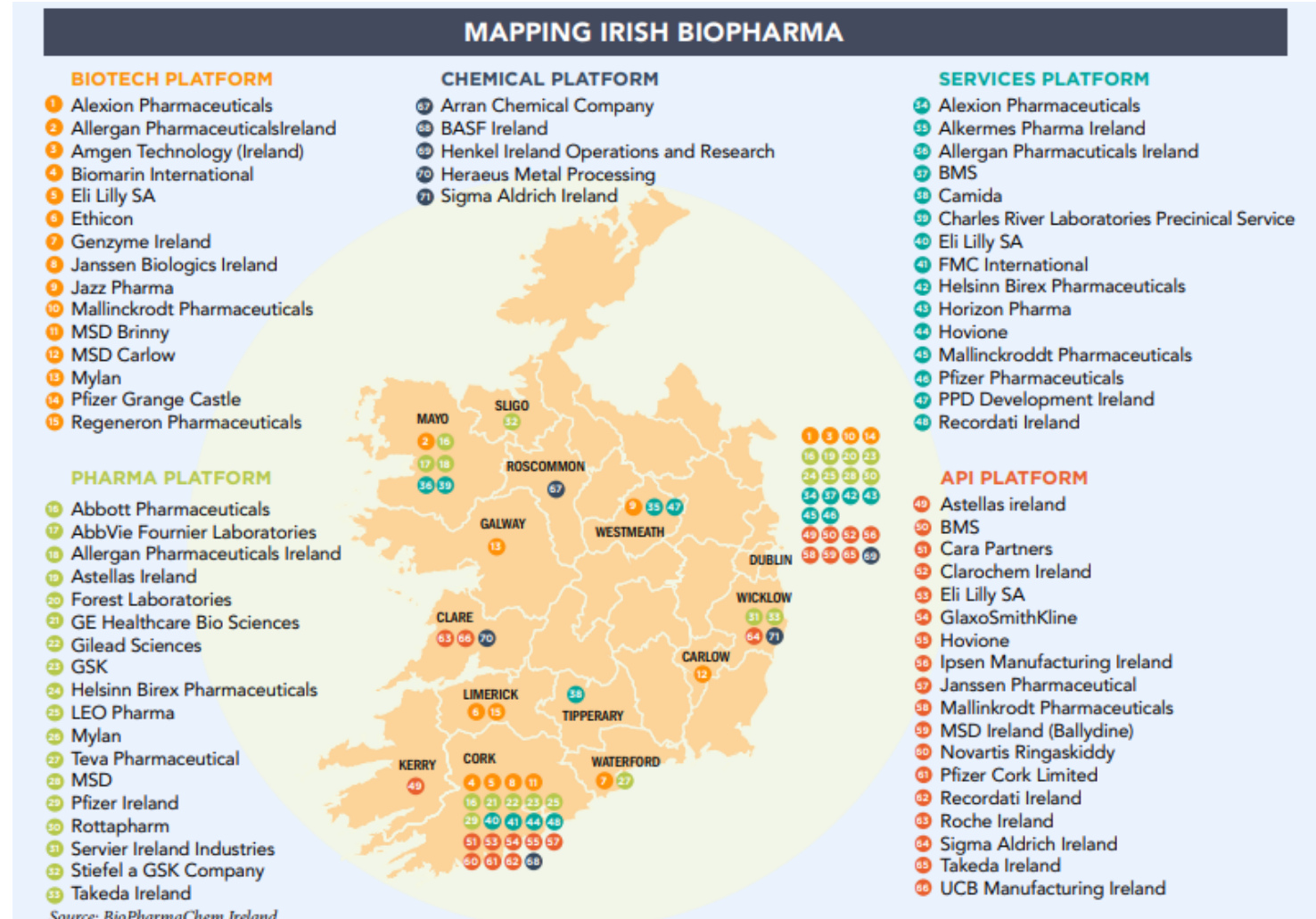
- Lack of expert local manpower for niche positions (especially in innovation)
 - High labor costs
 - Rising costs of living and doing business
 - Small domestic pharmaceutical market
 - Small domestic population for clinical trials
-
- Growth of logistics infrastructure in neighboring countries (China, Malaysia, Thailand)
 - Increased competition both domestically and regionally
 - Heavy reliance on China and India for APIs
 - Rising counterfeit pharmaceutical market
 - Loss of revenue due to patent expirations



Ireland Pharmaceutical Industry

Pharmaceutical & Medical Device Companies

-85+ biopharma companies
-50 out of 90 facilities are FDA approved

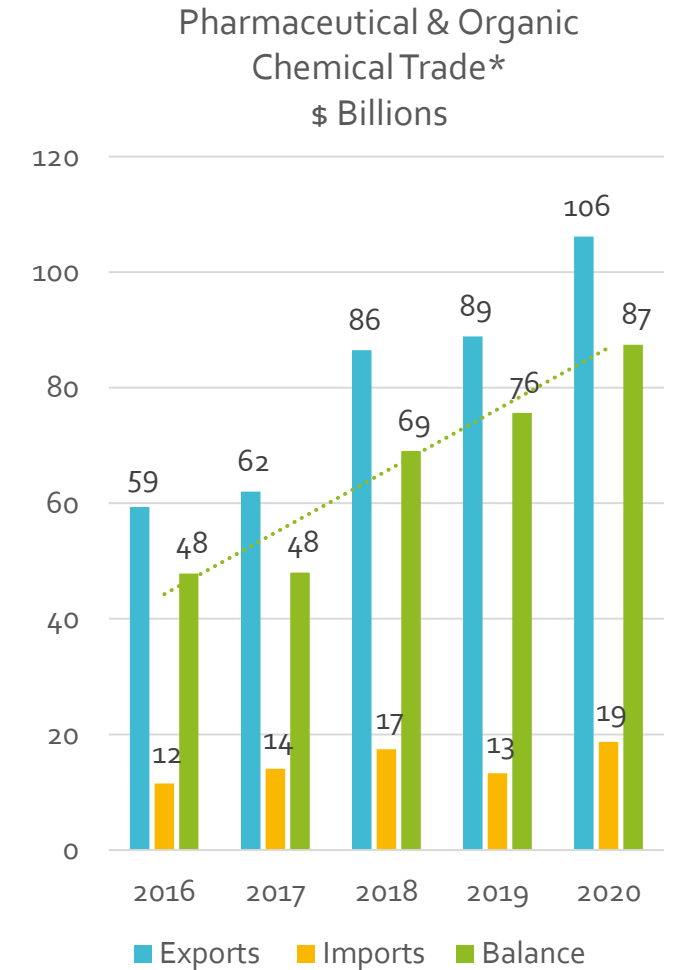


Source: Pharmaboardroom.com; Healthcare & Life Sciences Review: Ireland. Note: Map may not reflect new additions since 2017.

Ireland Pharma Market Outlook

Pharmaceutical & Organic Chemicals Trade Balance

- Pharmaceutical production market \$119 billion
 - Forecast to grow at a CAGR of 3.2% between 2021-2026 (Euromonitor)
- Ireland's pharmaceutical and organic chemical exports account for ~10% of global exports
 - \$106 bn exports; Third behind Germany
 - \$90 bn trade surplus and positioned for continued growth

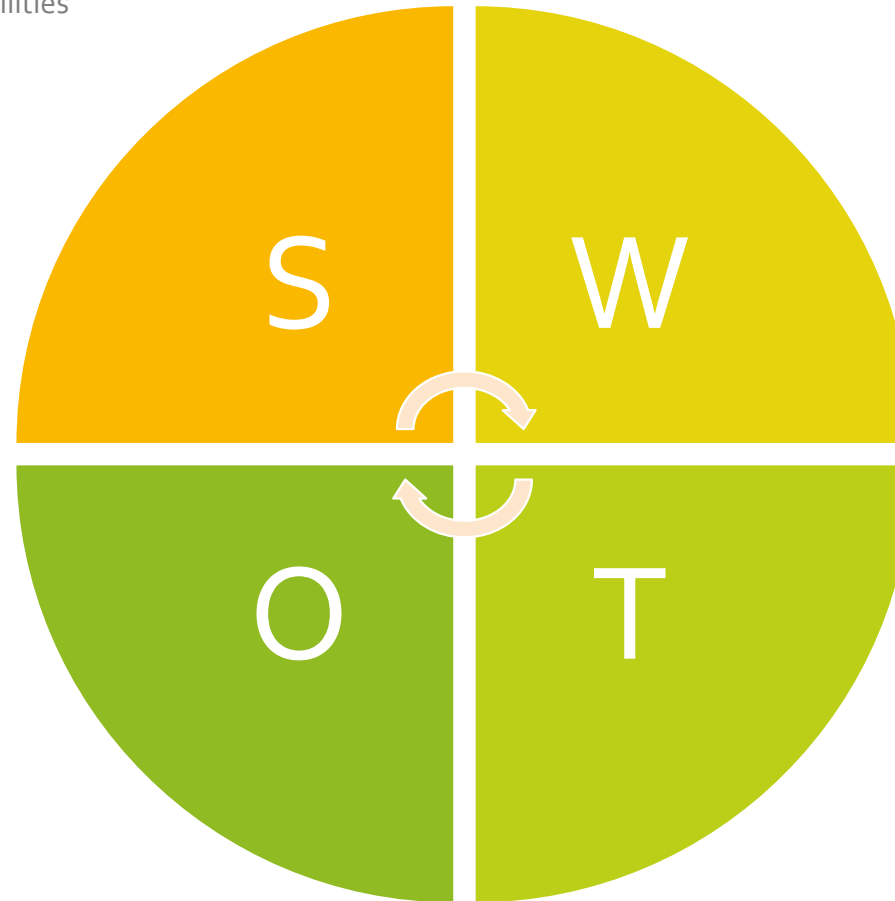


Source: UNCTAD; includes HS29 & HS30 commodities only

Ireland Pharma Industry

- Manufacturing hub with state of art strategic facilities
- Consistent industry strategy
- Largest net exporter of pharma in the EU
- Young, talented and skilled population
- Below EU average labor costs
- 1st for adaptability & flexibility
- 1st in Europe for investment incentives
 - Low corporate tax rate (12.5%)
 - 25% R&D tax credit
- 2nd most competitive economy in EU
- Hosts top 10 pharma companies
- Strong regulatory framework; FDA approved
- Cross-industry collaborations

- Only remaining English-speaking EU nation
- Well positioned to serve EU and U.S.
- Expansion at new manufacturing facilities
- Brexit – former UK capacity going to Ireland



- Small domestic market
- Limited Irish public awareness of life science sector
- FDI dependence
- EU convergence pricing system
- Federal cost-containment measures
- Low logistics performance index
- Fragmented logistics market
- Low container port throughput
- Small vessels & low container carrying capacity

- Low-value manufacturing
- Patent expirations / generic drug competition
- U.S. and OECD tax laws aimed at reducing Ireland's tax heaven attractiveness

