Mapping Trade Value Chains for SMEs and Humanitarian Resilience
Method and Preliminary Findings for Pilot Project and Online Trade Data Service Design[*]

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ABSTRACT

Presents method and preliminary findings from a Pilot Project that sought to identify alternatives to disruption for four critical imports, utilizing databases on trade, and identifying alternative sources of imports. It also sought to evaluate some feasibility components of an Online Service for small and medium enterprises (SMEs) providing information on Trade Value Chains to help build resiliency.

KEYWORDS

trade value chains; value chains maps; relief goods; disaster; resilience; bill of lading

INTRODUCTION

Hurricane Maria's impact on Puerto Rico disrupted trade value chains of small and medium enterprises (SMEs), leaving approximately 80-90% of the 45,000 SMEs that sustain PR's economy by generating 83% of employment and 53% of Gross Domestic Product, inoperative.[1] Some estimates assert that two thirds of the island's roughly 45,000 small and midsize businesses closed temporarily; and that 5,000-10000 businesses won't ever reopen. Agriculture was destroyed, with 50-80% of crops lost.[2]

With Puerto Rico importing 85% of its daily food consumption, food supply chains were severely disrupted. Over 300,000 Puerto Ricans fled to Florida after the hurricane (9% of the island's population).[3] Port activity collapsed in Puerto Rico or closed down due to impacts and post-hurricane sea currents (ex. Jacksonville port, Florida). FEMA supplies were slow in coming and disaster aid has stalled for years. The January 2020 earthquakes destroyed businesses in the southern part of the island; and two months later, PR faced the global COVID-19 pandemic.

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[1] http://sincomillas.com/las-empresas-locales-generan-el-83-del-empleo-y-el-53-del-pib/

Crop sales generate about $271 million a year led by production of plantains, vegetables and melons, nursery and greenhouse crops, fruits and coffee. Livestock sales are about $276 million led by milk production, poultry and cattle, the report said.in Puerto Rico https://www.agweb.com/article/farmers-say-maria-wrecked-bright-spot-of-puerto-rico-economy-apnews/

[3] Pedro Cabán, "Puerto Rico's Forever Exodus"

What became evident was that for islands, resiliency capabilities' building in trade value chains is crucial in disaster and emergency settings, both for people and businesses. The Graduate School of Business Administration at the University of Puerto Rico, Rio Piedras Campus, has helped SMEs develop trade strategies since 2015. Since Puerto Rico doesn't have an articulated Strategic Trade Policy nor a Trade Value Chain Analyses' Institute, the school sought to contribute to generate Strategic Export Plans for SMEs applying an original method developed by two of its professors (see Aponte-García and Orengo-Serra, 2020).

Strengthening trade value chains will build resilience. Exports allow SMEs to gain access to alternative sources of income, sales, and inventory management located in another country not affected by the disaster. Alternative network of suppliers help build resilience and contribute to avoid situations like those confronted in 2017 when Florida ports were closed down. Imports from alternative sources and transportation logistics (air) might also strengthen humanitarian logistics for incoming relief supplies.

There are two crucial steps in building resiliency according to the Massachusetts Institute of Technology's Disaster Supply Chain Institute. For each step, there is a gap for SMEs established in Puerto Rico. The first step is to Map and Understand the System. Mapping critical supply chains and infrastructure to understand where critical goods (and their essential ingredients) come from and how they might move down the chain to an area affected by disaster (Meyer and Meyer, 2017: 11). The second step is to Map supply chains by using bill-of-materials (BOMs, list of all the materials and parts that a manufacturer needs to create a certain product) for products to understand the implications of supplier disruptions. This step is mostly available for large companies with inventory management or that use third-party supply chain risk management services that gather information on suppliers' geographic locations (Meyer and Meyer, 2017: 11).

But SMEs usually don't have a Map of Trade and Supply Chains nor a Bill of Materials. In fact, co-coordinating the initiative on developing Strategic Export Plans for SMEs during 2015-2017, confirmed that most SMEs don't even know the Harmonized Schedule code of the product they sell or import. This is crucial since most trade databases and tariffs are organized on this basis. The two steps inform our approach to bridge two gaps: no map of trade value chains; and no Harmonized Schedule Code knowledge.

Mapping trade value chains is also fundamental for humanitarian organizations and relief agencies tasked with getting and delivering critical goods fast (see <http://www.fritzinstitute.org/prgSCCERT_CHL_OverView.htm>). Therefore, information on trade value chains on goods deemed critical after the hurricane and earthquake –water, gas, diesel, tents, and bread- is crucial for agencies, governments, non-governmental organizations and businesses.

Critical-essential and potential-growth goods from these sectors that can help diversify trade (import and export) under disasters to enhance business and socioeconomic resiliency and preserve and create jobs. Critical goods encompass those products that are scarce under crises, such as water, and humanitarian relief goods; or are affected by disruptions in international, regional or local supply chains, such as goods affected by freight and sea transportation interruptions due to hurricanes. Potential-growth goods encompass sectors that prove crucial to recovery by diversifying risk under disaster, enhancing business resiliency and preserving or creating jobs, such as medicines, pharmaceutical goods and solar cells after hurricanes. Project incorporated critical goods under the COVID-19 pandemic as atmospheric disaster might coincide with a pandemic scenario.

At present, this is an excellent time to consider alternative supplier networks since most probably, the US government will rescind Cabotage Laws for Puerto Rico for the next two years

[<<https://www.metro.pr/pr/noticias/2020/02/19/estados-unidos-exima-a-p-r-de-leyes-de-cabotajepor-dos-anos.html>]. This opens up new opportunities to establish alternative network of suppliers in the Greater Caribbean region, particularly with countries that have in place free trade agreements with the U.S., such as DR-CAFTA (Dominican Republic-Central American Free Trade Agreement) and USMCA (US-Mexico-Canada); or with ports other that Southern eastern ones in the US. Research project is located in the theoretical context of value chains, trade in goods and businesses by linking concepts to quantitative measures. Chains allow you to map the activities and transformations products undergo from entry as raw material to final good.

Research addresses a knowledge and methodological gap in research: there is no method of analysis linking chains, companies and annual international trade data. How can we link companies and business data for analyses purposes when Customs withholds company information for confidentiality reasons? Mapping and analyses must be linked to databases so that research does not depend on qualitative methods focused solely on case studies, which offer the advantage of in-depth analysis, but can't be generalized. For method considerations, the most important contributions are: Sturgeon and Gereffi (2009), Sturgeon and Memedovic (2010), and Aponte García (2018, 2020) because they present conceptualizations linked to international trade databases and quantitative methods.

However, the biggest challenge remains to be solved: linking annual trade data with information on companies, considered confidential, and therefore not published. Author found a new database that includes information on exporters and importers. This is novel in literature. Steps in method are original.

The project's goals were to:

• Foster resilience enhancing capabilities for SMEs to support and strengthen economic development strategies linked to trade value chains.
• Strengthen import-export capability of SMEs and strengthen capacity to address vulnerabilities within the economy.
• Promote University of Puerto Rico's contribution to trade value chains in the context of disaster.

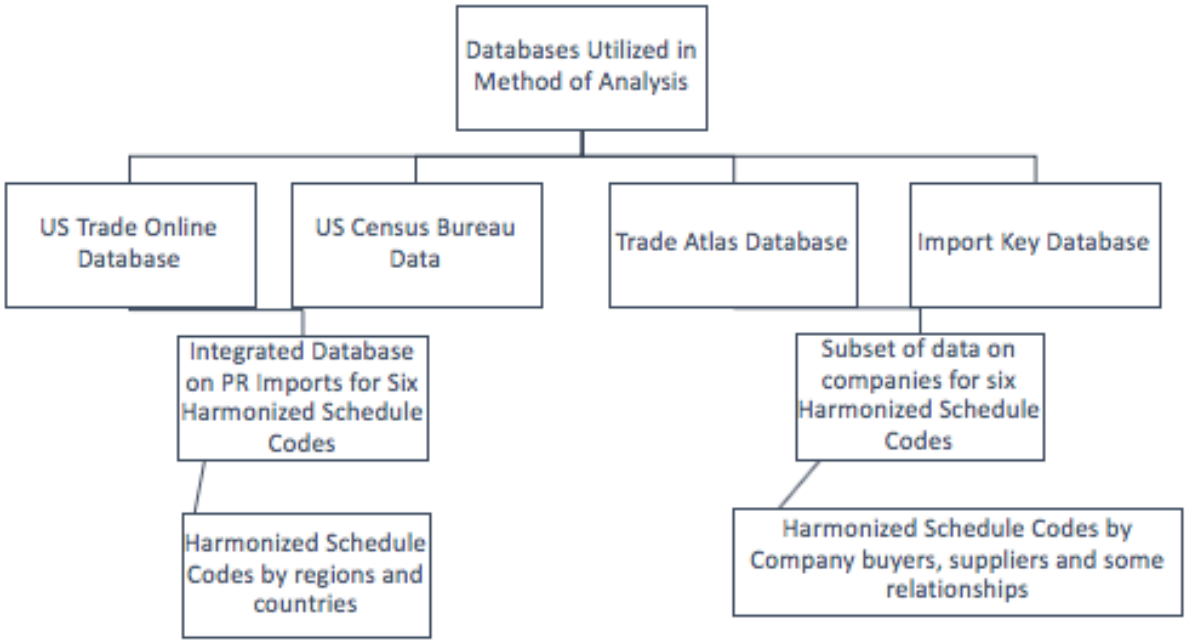
Deliverables include: two cases of critical goods' trade value chains: and two cases of SMEs potential export products. It generated: maps/diagrams by Harmonized Schedule (HS) code and ports for alternative suppliers.

METHOD

Mixed methods were employed. Concept required obtaining information from trade databases in order to be able to identify alternative supplier networks to help build resiliency.

Obtaining up-to-date data on Puerto Rico's imports and exports is a challenge. Four databases were utilized and six were examined. Included among those examined are data from the Planning Board of Puerto Rico (available until 2018 only); Trade and Export Company of Puerto Rico data (available until 2016 only) and four other databases as presented in Figure 1. Each database was analyzed to identify limitations.

Figure 1. Databases Utilized in Method of Analysis



Source: Aponte-García's elaboration.

Steps applied in method included:

1. Select products for analysis: two critical imports, two SMEs exports.

2. Six sectors were pre-selected for Puerto Rico and United States: water, solar, masks, diagnostic reagents, and relief goods. In the end, the Pilot Project centered its analysis on water, relief goods and diagnostic reagents for reasons that will be specified in the Findings Section.

3. Analyzed data for products in different databases: US Trade Online, Import Key, Trade Atlas, USA Trade Online; Puerto Rico Trade and Export Company Database; Puerto Rico's Planning Board data, among others. 5. Final selection of four Harmonized Schedule codes were: water, relief goods, diagnostic reagents, and solar cells, as illustrated in Table 1.

Data limitations included the following. USA Trade Online offers data on Puerto Rico's imports and exports from world countries. However, it doesn't present data on trade between the US and PR. For that reason, I then had to identify data from the US Census Bureau that presents data on PR-US trade; and integrate information from both sources. Pre-selected sectors underwent analysis of exports and imports from the US to Puerto Rico and from PR to the US by HS code.

Table 1. Selected products by Harmonized Schedule (HS) Code

	HS CODE	Description
Critical goods under hurricane disaster (based on Meyer and Meyer, 2017)		
WATER		
1	220110 220190	Mineral waters and aerated waters, natural or artificial, not sweetened or flavored Waters Not Sweetnd Or Flavored Nesoi; Ice And Snow
Potential goods for export to diversify risk under disaster and enhance business resiliency		
MEDICINAL & PHARMACEUTICAL		
RELIEF (EXCLUDES WATER)		
2	980220 980230 980240 980210	980220 Medicinal & Pharmaceutical Exports, Donated 980230 Wearing Apparel, Donated For Relief Etc, Exports 980240 Articles Donated For Relief Etc., Nesoi, Exports 980210 Commingled Food Exports, Donated, Relief/charity
3	382200	Diagnostic reagents based on polymerase chain reaction (PCR) nucleic acid test. COVID-19 Test kits (molecular)
	SOLAR	
4	854140	Solar cells

Source: Aponte-García's elaboration based on following references: Meyer, Andrea and Meyer, Dana (2017) Available at: <https://humanitarian.mit.edu/wp-content/uploads/2019/12/Supply-Chain-Resilience-Restoring-Business-Operations-After-a-Hurricane.pdf>. p. 11; and N.A. 2020. HS classification reference for Covid-19 medical supplies. Available at U.S. government, List of COVID-19 related products. (<https://www.everycrsreport.com/files/20200406_R46304_eb118726bdc67022d3e8b0d09e76381b23e0a485.html#_Toc37165319>.)

4. Evaluated HS codes' data on Trade Atlas database. Database includes only a subset of data, not all cases imported by a given country. Database subscription allows unlimited download, but only for 15 products, Americas package. Also, it doesn't allow researchers to publish company names in academic articles. Compiled materials on Harmonized Schedule Tariff Codes, defining specific codes for data to be downloaded from database. This revision included both codes for critical goods already identified in literature review for post-hurricane scenarios; and COVID-19 critical goods for a possible COVID19-pandemic-hurricane scenario.

Downloaded data and prepared Excel files for critical goods and for SMEs exports (two goods). Completed download of data for products and created integrated data files. Designed working process and started generating maps of alternative supplier networks for import of critical goods; and potential SMEs export markets including the Americas (including names of exporting

and importing firms). Started generating integrated database. Started analyzing arrays of data to generate tables that will be included in final essay

Although Trade Atlas data expert informed me that database didn't include Puerto Rico, once I started downloading and analyzing data, I was able to figure out a way to identify cases related to Puerto Rican imports. Then, I reconceptualized method to focus on Puerto Rico's data and generated integrated database to complement analysis based on United States Trade Online (UTO) and United States Census Bureau (USCB) data, as stated earlier. Trade Atlas provides a trade value for imports only for some cases.

5. Generated an integrated database for Puerto Rico's imports from world for six HS codes. For this group, steps 6 and 7 of the method are applied.

6. Evaluated HS codes' data on Import Key database. Includes only a subset of data, not all cases imported by a given country. Includes data on Puerto Rico's imports and some exports from world countries. Database does not provide a trade value; but provides data on quantity traded in kilograms, buyers, suppliers, and some of the relationships among these.

7. Identified alternative supplier network solutions to disruptions in trade value chains at several levels: region, foreign port of receipt (usually coincides with country of origin); foreign port of lading, buyer and supplier. In this way, tables-maps for each product can be created for analysis, presented under section on Findings.

8. Created tables (maps) of import suppliers and export markets (including names of importing and exporting firms (when available)). Method will advance resilience to disaster by creating alternatives to trade value chain
disruptions.

Method Addresses Knowledge and Methodological Gaps in Research

First, original method addresses a knowledge and methodological gap in research: there is no method of analysis linking international trade data, supply chains, and companies. How can we link companies and business data for purpose of analysis when customs withholds company information for confidentiality reasons? Mapping and analysis must be linked to databases so that research does not depend on qualitative methods focused solely on case studies, which offer the advantage of in-depth analysis, but can't be generalized. For method considerations, the most important contributions are those of Timothy Sturgeon and Gary Gereffi (2009), Sturgeon and Olga Memedovic (2010), and Maribel Aponte-García (2018, 2020) because they present value chain conceptualizations linked to international trade databases and quantitative methods. The proponent has found two new databases that include information on importers (companies' names and locations). This can help address the biggest challenge: linking trade data with information on companies' names and location.

Second, it analyses global disruptions in supply chains, an under-researched topic. Although some governments, businesses and social organizations have supply chains' contingency and risk-mitigation plans to respond to local or regional disruptions such as atmospheric and telluric events, no such plans exist for global disruptive health-pivoted events like covid-19. In the case of Puerto Rico, research needs to be informed by resiliency lessons from atmospheric and telluric events, as hurricane season in the context of the COVID-19 pandemic crisis, poses a potentially

critical health-crisis scenario with power, communications, internet and water outages; supply and trade chains' disruptions; and a humanitarian crisis. The effects of cyclone Amphan in India and Bangladesh on may 2020 were the first case of such scenario.

In some industries, the pandemic has brought about cries for redesigning supply chains in a more diversified manner, decreasing reliance on Asian locations and promoting production closer to home, a change that might prove beneficial for the biotechnology and medical devices sectors in puerto rico, with lobbying efforts in that direction already under way. Agricultural and food sustainability has also gained prominence as disruptions associated to covid-19 outbreaks hit us meat processing plants.

Third, it will generate an integrated database with company names. Database on alternative trade maps and buyer-supplier networks will provide a valuable resource for the wider scientific community to pursue a multitude of studies that have not been previously possible due to a national or regional focus on supply chains and to lack of information on companies exporting and importing goods within trade chain analyses.

Fourth, it will contribute to the scarce literature on natural disasters' effects on businesses. A crucial step in building resiliency, according to the Massachusetts institute of technology's disaster supply chain institute, and an understudied area, is to map and understand the system. Mapping supply chains and infrastructure to understand where critical-essential goods come from and how they might move down the chain to an area affected by disaster, is crucial for agencies, governments, non-governmental organizations and businesses.

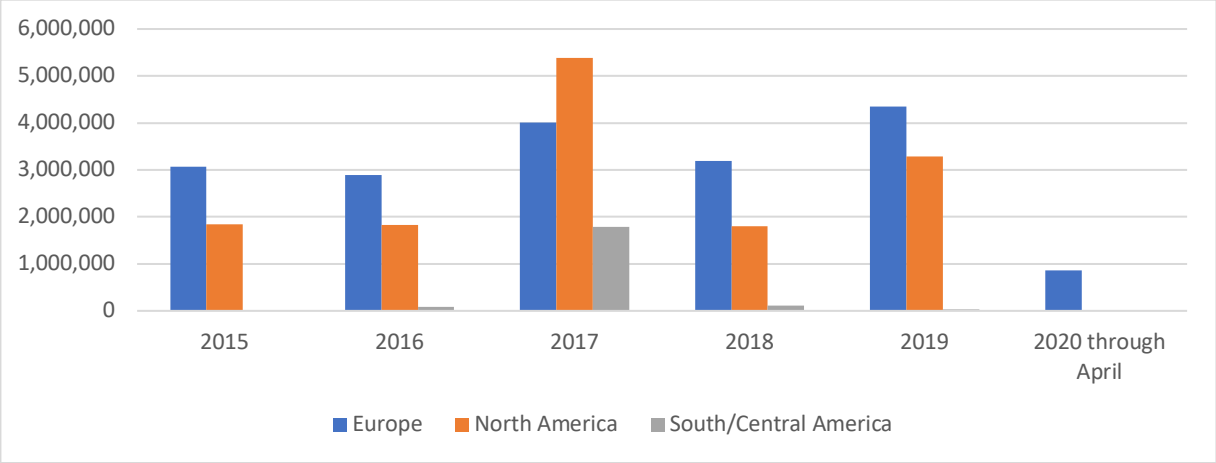
Fifth, it will contribute to generate an analysis on strategic options for Puerto Rico. In the last three years, Puerto Rico has confronted hurricanes, earthquakes and a global pandemic. Covid-19 has infected almost three thousand people and killed over one hundred. After the two-month-long lockdown, the economic toll is at $6.6 billion and unemployment at an estimated 37-46%. Some sectors have been particularly hard-hit, such as tourism, retail and food service; and small businesses are failing. However, other sectors have exhibited good growth potential (food and agriculture, health, education, drugs and medical devices, pharmaceutical). The task at hand is urgent, as drastic unemployment threatens to generate an unprecedented socioeconomic crisis.

PRELIMINARY FINDINGS

1. Water

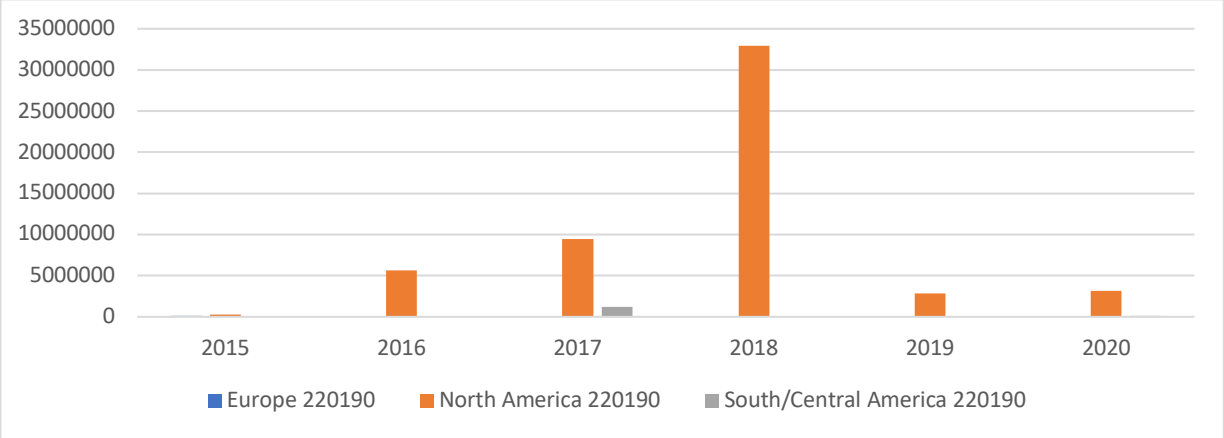
Data analyses of water imports revealed several significant preliminary findings. Two HS codes were analyzed, 220110-Mineral waters and aerated waters, natural or artificial, not sweetened or flavored; and 220190-Waters Not Sweetened or Flavored (nesoi-not elsewhere identified), Ice and Snow. Based on official data from the United States Census Bureau and the United States Trade Online Database, one graph was created for each product. Detailed tables for each HS code are included as Appendix 1.

Figure 2. Puerto Rico's Imports from the World, By Region, in US$, current prices
For HS codes 220110: Mineral waters and aerated waters, natural or artificial



Source: Authors' elaboration based on USA Trade Online and US Census Bureau.

Figure 3. Puerto Rico's Imports from the World, By Region, in US$, current prices
For HS Code 220190: Waters Not Sweetened or Flavored



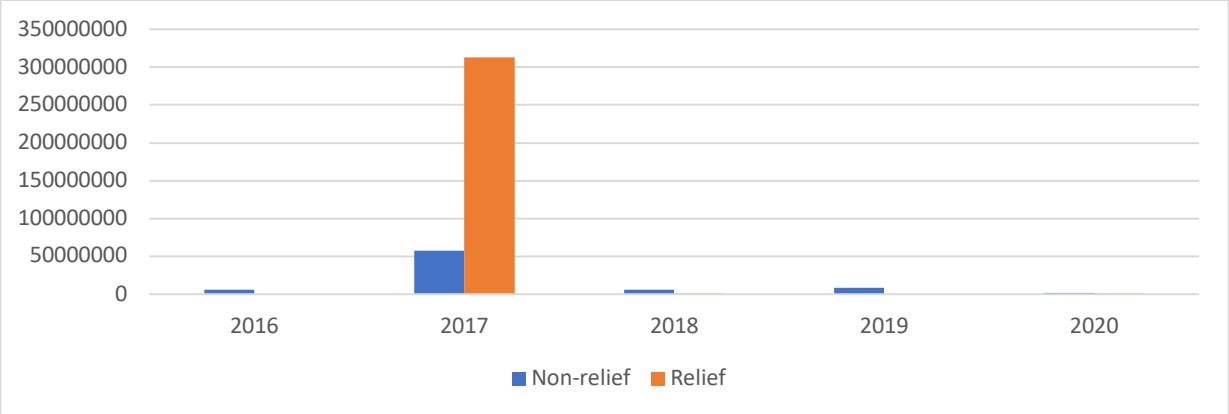
Source: Authors' elaboration based on USA Trade Online and US Census Bureau.

As expected, North America prevailed against the other regions, due to the significance of U.S. dominance, particularly for years 2017 and 2018. Notwithstanding, Europe holds an important position in the market of HS Code 220110, that captures mineral waters which tend to be more expensive; while HS Code 220190, which is "common" water, a critical and essential good during disasters, and highly scarce in Puerto Rico in the aftermath of Hurricane Maria, is dominated by the Puerto Rico's imports from the U.S.

Further analyses were carried out to capture the contribution of water relief goods. In this case, there is not a particular HS code devoted to this category. But interestingly, the Import Key database identified this product under several categories, including HS codes 220110 and 220190, among others. Although presented in kilograms, given that this database doesn't present dollar values for goods, an analysis was developed to create two categories, water as a relief and non-relief commodity.

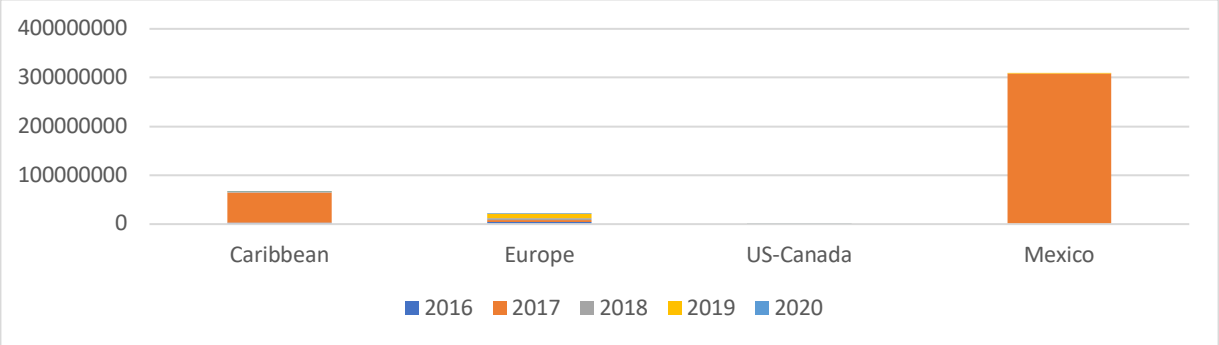
As expected, and shown in Graph 1, imports in relief water grew significantly in 2017 because of Hurricane Maria's impact. But as illustrated in Graph 2, it was the Caribbean region that most significantly contributed to bringing water to Puerto Rico, with Mexico playing a pivotal role. However, as stated in the Data Limitations Section, Import Key presents a subset of data and doesn't necessarily include all data available on Puerto Rico's imports from the United States.

Figure 4. Puerto Rico's Water Imports (HS CODES 220110 AND 220190)
As Relief and Non-relief Commodities, in KGs



Source: Authors' elaboration based on Import Key.

Figure 5. Puerto Rico's Water Imports (HS CODES 220110 AND 220190)
As Relief and Non-relief Commodities, in KGs
By Place of Receipt (Origin), Significant Regions and Countries

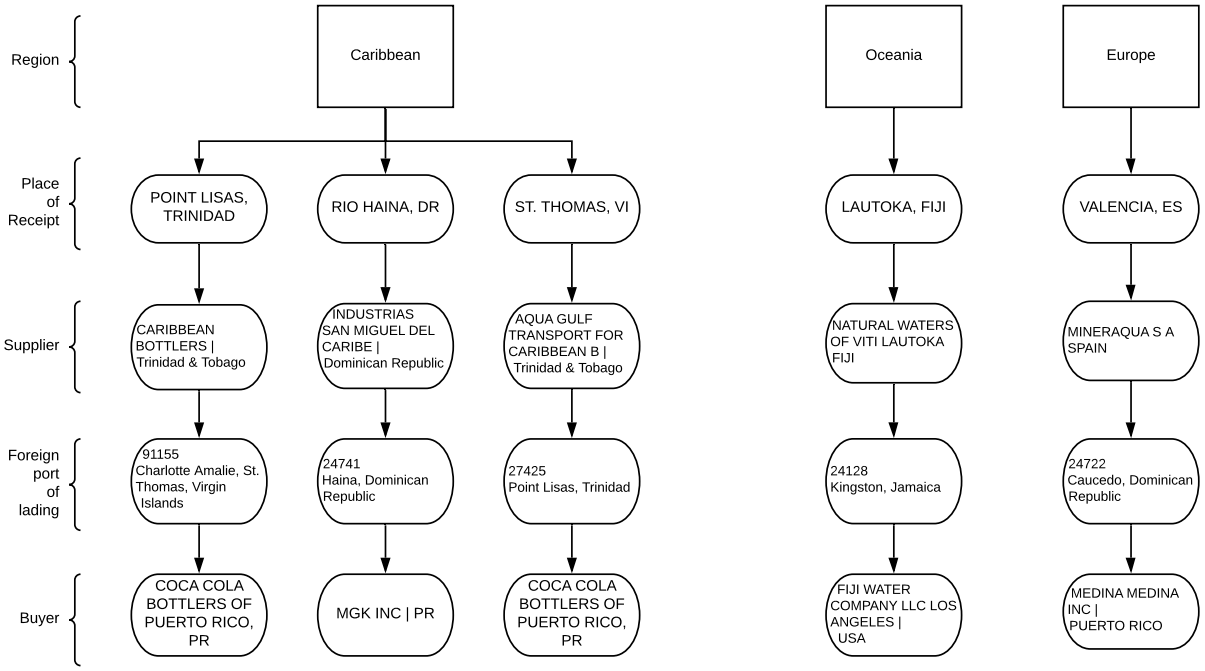


Source: Authors' elaboration based on Import Key.

Nevertheless, this subset of data reveals that shipments originated (place of receipt) mostly from within the Caribbean region. The lesson is that in times of crises-disasters, the Caribbean's response as an alternative supplier network must be further developed.

We then analyzed Puerto Rico's water supply chains based on Import Key data. Figure 6 below presents, in kilograms, the top five suppliers' supply chains, distinguishing between companies and humanitarian relief organizations. The significant preliminary finding is that, for both companies and humanitarian relief organizations, importing from the Caribbean region was crucial. Humanitarian relief organizations imported from the Caribbean and Mexico (categorized as North America). Companies imported from the Caribbean but also from Oceania and Europe. When disasters strike, rapid response depends on Caribbean ports. As table 2 below illustrates, foreign ports of lading were all Caribbean, including Dominican Republic, Mexico, Trinidad and Tobago and Virgin Islands. For tables on Supply Chains for other years (2016, 2018, 2019 and 2020), see Appendix 2.

Figure 6. Puerto Rico. Water Imports' Supply Chains for Companies, 2017
(for top five shipments in kgs)



Source: Carlos A. Álvarez's elaboration based on Import Key database.

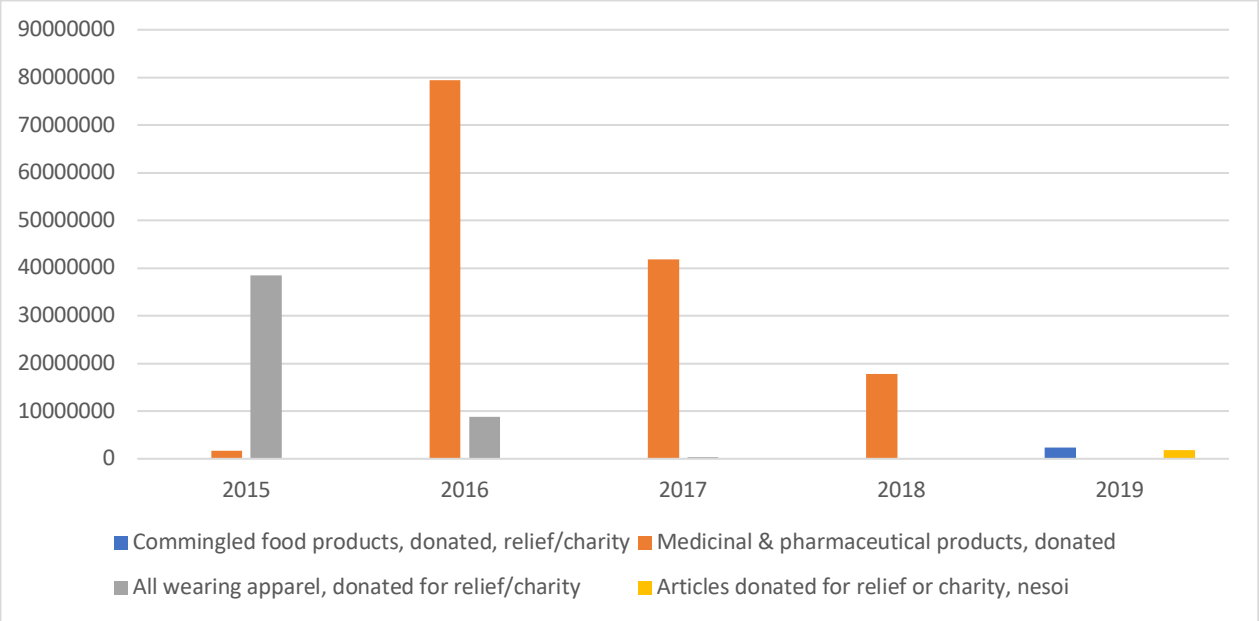
2. RELIEF GOODS

The category of relief goods encompasses four components at the six-digit level:

HS Code 980210, Commingled Food Products, Donated, Relief/Charity
HS Code 980220, Medicinal & Pharmaceutical Products, Donated
HS Code 980230, All Wearing Apparel, Donated For Relief/Charity
HS Code 980240, Articles Donated For Relief Or Charity, Nesoi

Based on official data from USA Trade Online and US Census Bureau data, a surprising finding was that Puerto Rico exported donations of medicinal and pharmaceutical products, in 2017 and 2018, in the crux of the post-hurricane devastation. When examined in detail, exports in 2017 were destined to Belgium (19, 42, and 17 million respectively, for years 2016, 2017 and 2018). Medicinal and pharmaceutical exports to Ethiopia (59 million in 2016). See Appendix 3 for breakdown of exports by country.

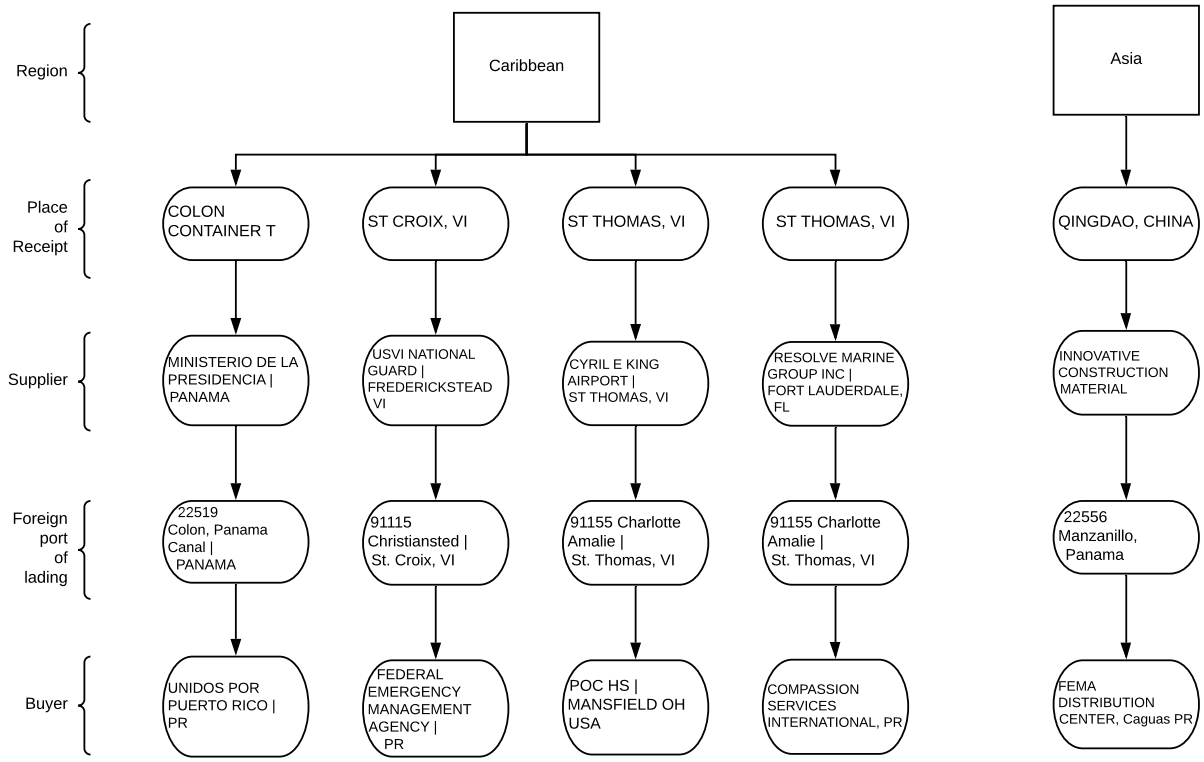
Figure 7. Puerto Rico's Exports to the World
Relief Commodities excluding water, In Kgs



Source: Authors' elaboration based on United States Trade Online and US Census Bureau data.

As illustrated in Figure 8, among the top five suppliers for 2017 is FEMA, the Federal Emergency Management Agency. FEMA imported supplies from China and the Virgin Islands. FEMA's supplies from Qingdao, China came through Panama as port of lading. FEMA's supplies from the Virgin Islands utilized Saint Croix, Virgin Islands as the port of lading. *Unidos por Puerto Rico*, in conjunction with the National Guard, imported goods from Panama and utilized the Panama Canal zone as port of lading.

Figure 8. Puerto Rico. Supply Chains for Imports of Relief Goods (excluding water), 2017 (for top five shipments in kgs)



Source: Carlos A. Álvarez's elaboration based on Import Key database.

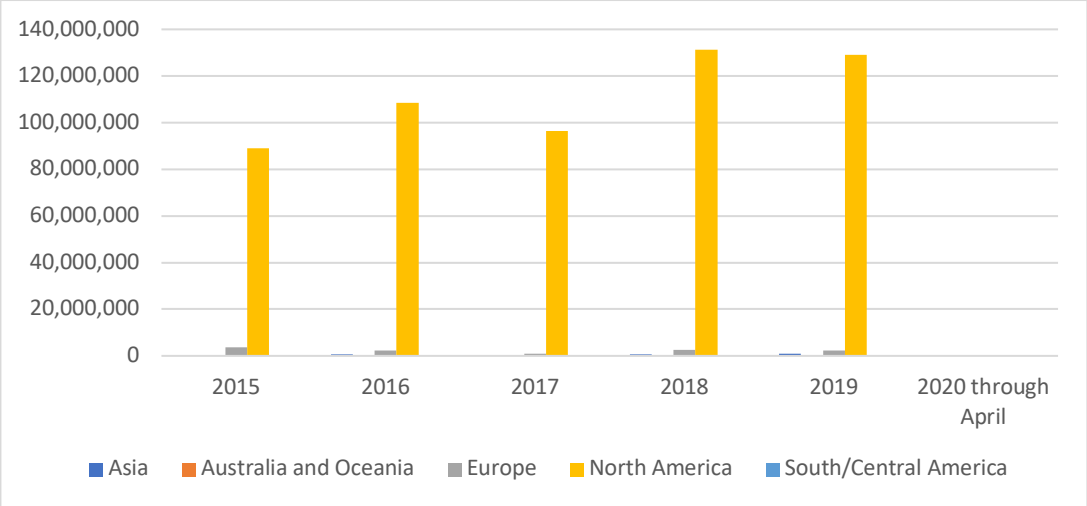
Again, data shows that the Caribbean was both important as place of receipt and of lading during 2017. Data for other years in included as Appendix 4. In this case, almost all buyers were humanitarian relief organizations and/or federal emergency disaster agencies.

The capability of Puerto Rico as an exporter of medicinal and pharmaceutical products, which accounted for the result presented in Figure 7, is tied to the Island's experience in this industry. Next, we analyze a related product within this industry, that of diagnostic reagents, as this category has become crucial within the context of the COVID-19 pandemic, with countries and companies seeking available supplies in order to carry out COVID-19 tests.

3. DIAGNOSTIC REAGENTS

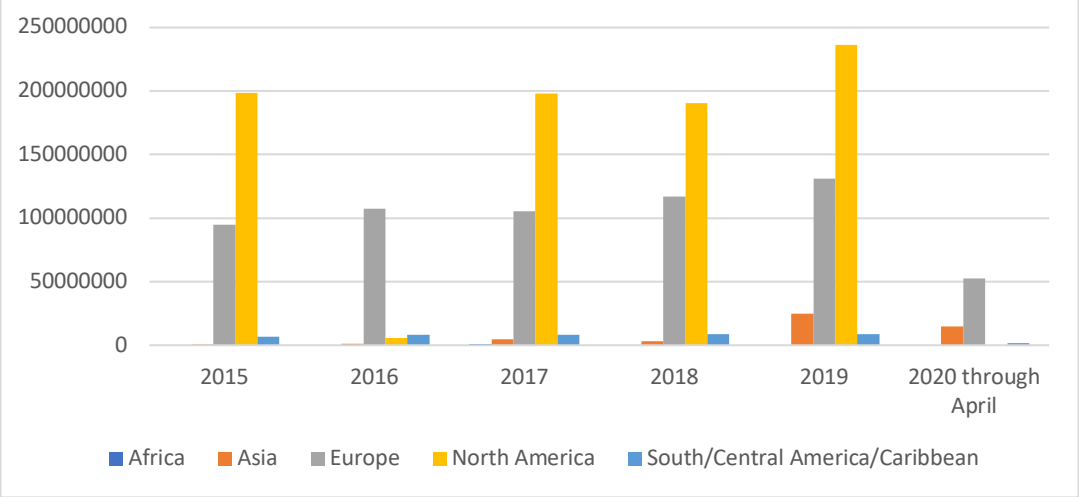
As Figures 9 and 10 illustrate, preliminary findings assert that Puerto Rico is both strong in imports and exports of diagnostic reagents, a category which houses the COVID-19 test kits. The purpose of exploring these data was to ascertain whether the Island could play a pivotal role if global supply chains are rescaled to a regional and U.S. national level. Both graphs below illustrate the centrality of Puerto Rico's trade with the U.S., although exports to Europe also play a significant role.

Figure 9. Diagnostic Reagents HS CODE 382200
Puerto Rico's Imports from the World, By Region, in US$



Source: Authors' elaboration based on USA Trade Online and US Census Bureau.

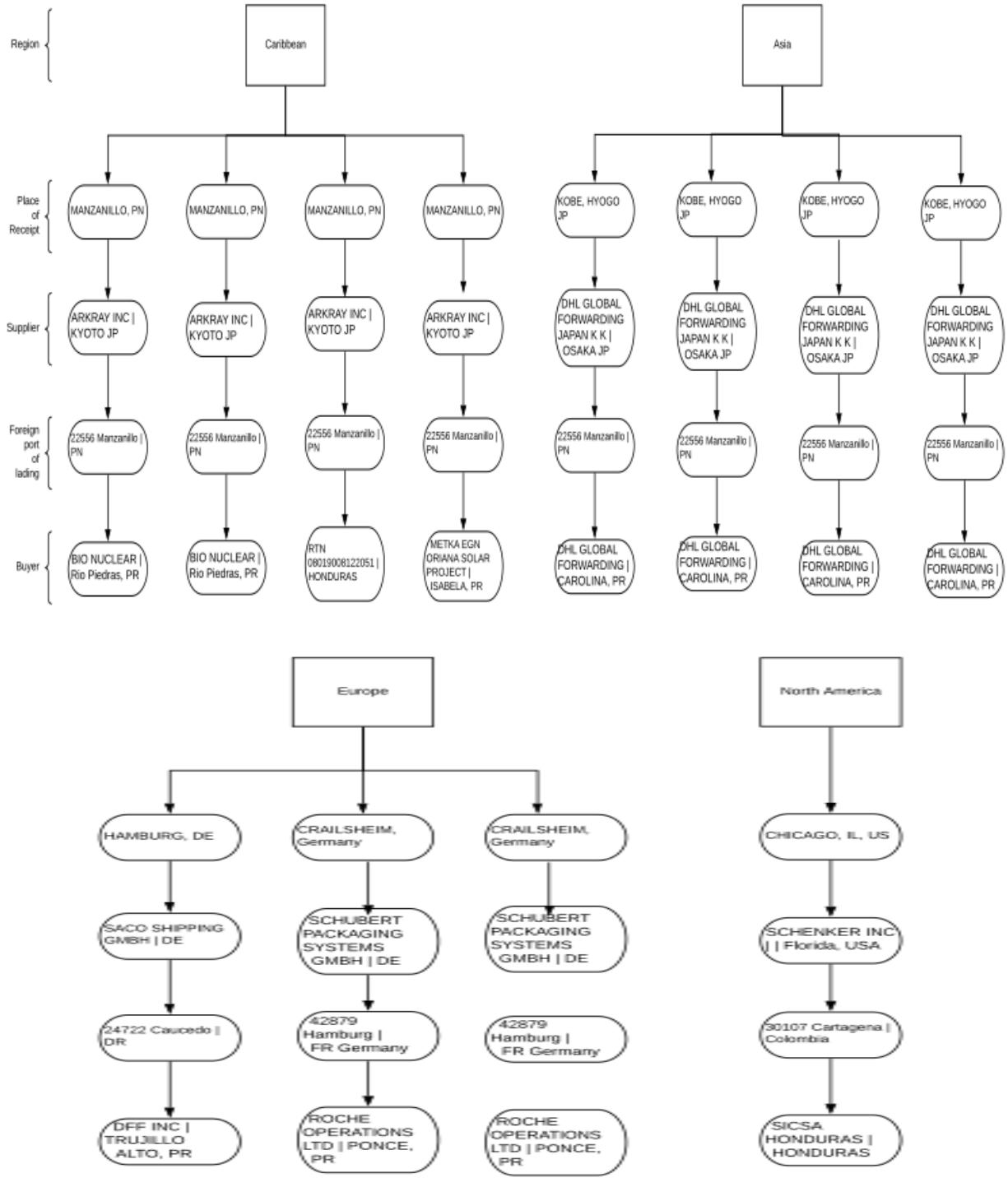
Figure 10. Diagnostic Reagents HS Code 382200
Puerto Rico's Exports to the World, By Region, in US$



Source: Authors' elaboration based on USA Trade Online and US Census Bureau.

Figure 11 in the next page illustrates the complexity of these supply chains. In this case, supply chains' diagrams capture relationships for the 2015-2020, and are not concentrated in one particular year. A detailed table of these cases is included as Appendix 5.

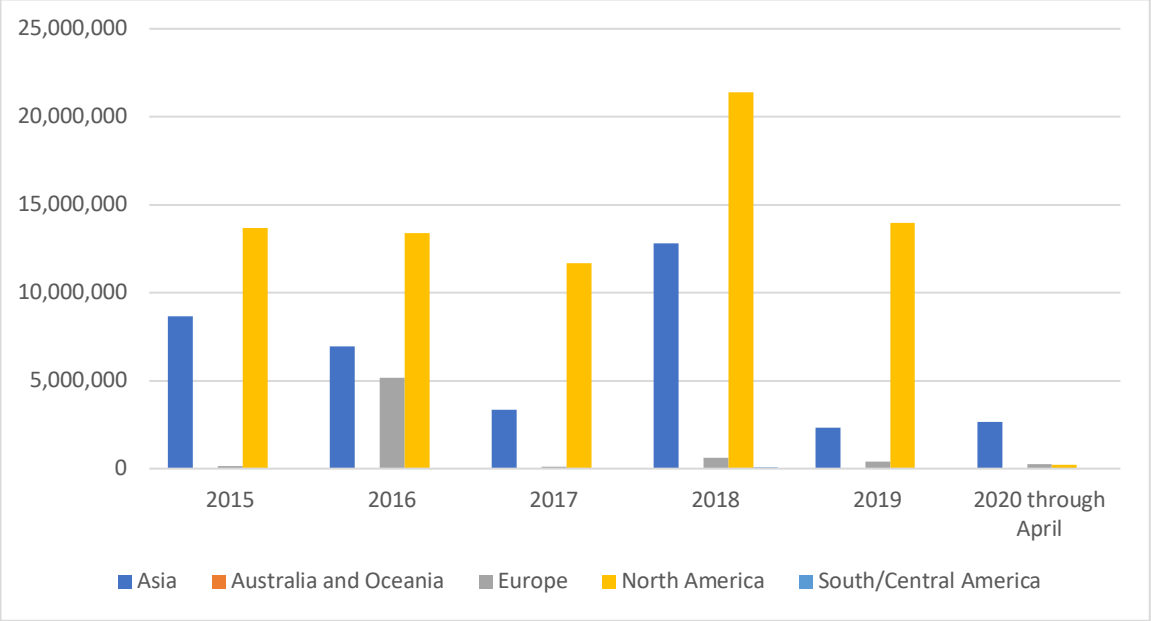
Figure 11. Puerto Rico. Supply Chains for Diagnostic Reagents (for top five shipments in kgs)



Source: Carlos A. Álvarez's elaboration based on Import Key database.

4. SOLAR

Figure 12. Photosensitive Puerto Rico's Imports from the World, By Region, in US$ HS CODE 854140

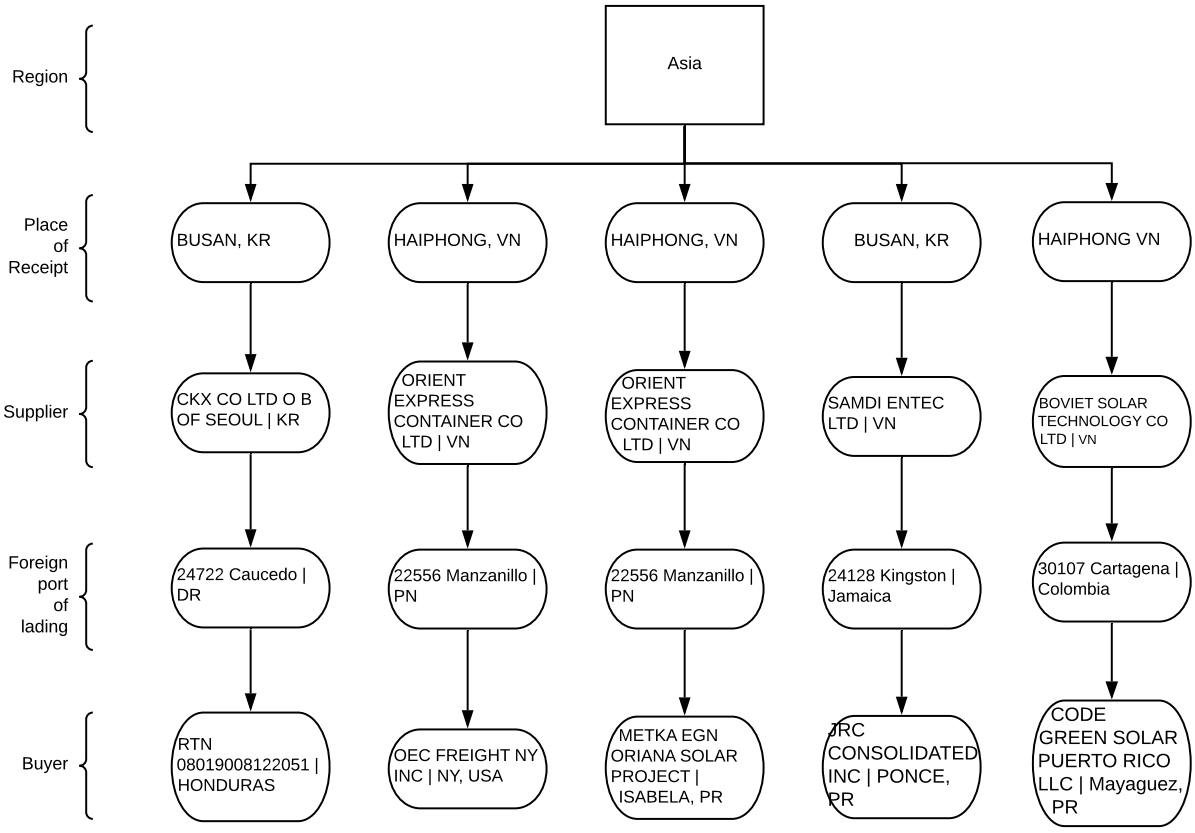


Solar products imports surged in 2018 as many in Puerto Rico confronted energy disruptions and blackouts for over six months. Imports from North America prevailed followed by Asia.

Within the context of the energy crisis and the economic depression that the country has experienced for years, compounded by the effect of Hurricane Maria in 2017 and earthquakes in 2020, the consideration of renewable energy alternatives is presented as a possibility of gaining access to electricity at fairer prices. Added to this is the complex financial situation faced by the public entity that owns services and electricity operations.

In Puerto Rico there are two types of photovoltaic solar companies: small and medium-sized local or foreign enterprises that design and install photovoltaic solar systems for homes or institutions; and local or foreign companies that function as large commercial systems or solar farms. Solar farms sell power to the government of Puerto Rico. In the category of small and medium-sized enterprises (SMEs) there are over twenty local companies. All of these companies operate in the downstream links of the chain. Both types of companies import components, mainly from China or the US; and some install interconnection to the network of Puerto Rico Electric Power Authority (EEA).

Figure 13. Puerto Rico. Supply Chains for Imports of Solar products, 2018 (for top five shipments in kgs)



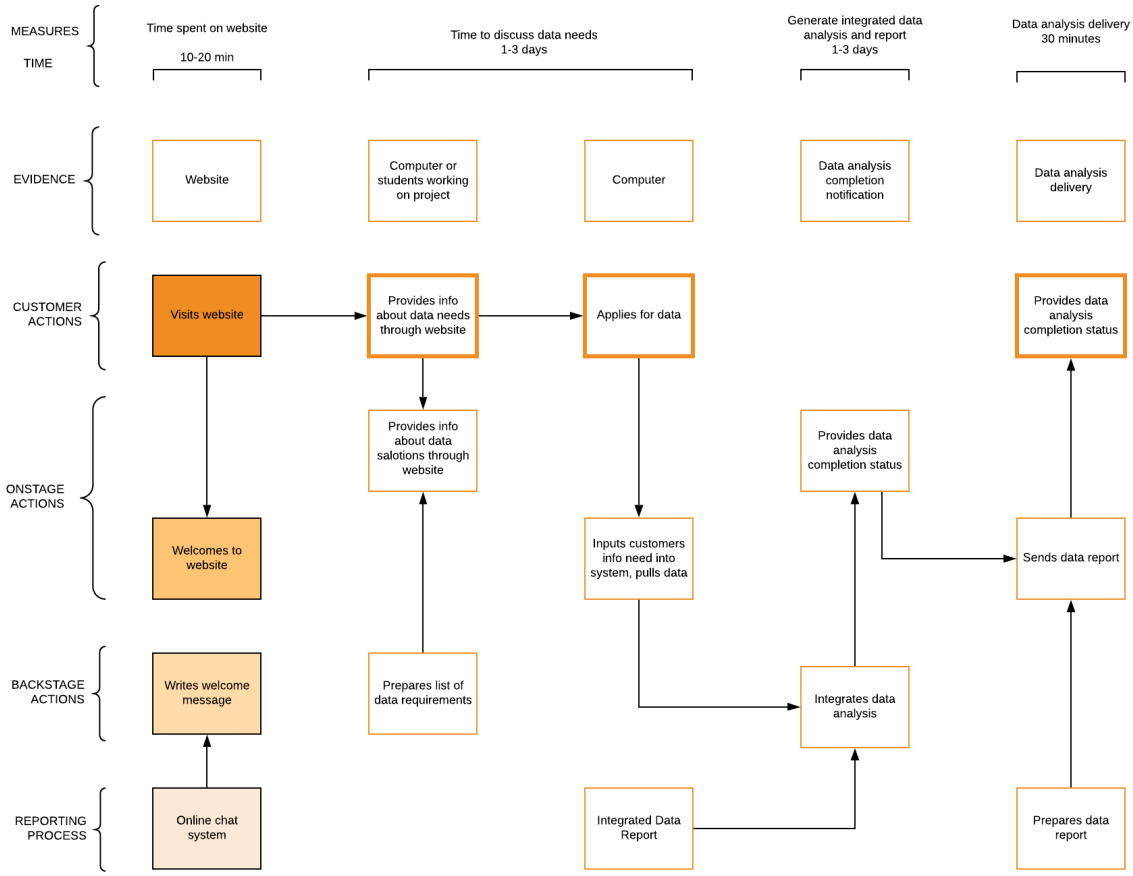
Source: Carlos A. Álvarez's elaboration based on Import Key database.

Figure 13 illustrates the dependency on Asian places of receipt for the subset of cases in available in the Import Key database. Foreign ports of lading are in the Caribbean region.

Analysis of Feasibility Components for Online Service

Proposed online service was conceptualized as an alternative to provide much needed (and inexistent at present) trade data to provide alternatives for humanitarian and SMEs logistics. The idea was to evaluate some feasibility components of online service's commercialization. A Blueprint for this service was created and is illustrated as Figure 14.

Figure 14. Blueprint for Online Service



Source: Aponte-García's elaboration.

In our evaluation, we studied the terms of service of Trade Atlas and Import Key to determine feasibility of: offering public service free of charge; or charge for data information.

Trade Atlas' Database subscription is very valuable as it includes company names and it is less expensive than other alternatives in the market. But for $1000 subscription, one can download unlimited data **only** for 15 products within the Americas. This would affect cost of online service's commercialization. Unlimited data for each product beyond the 15 allowed under subscription, costs $100 each. Since each imported product (say, for instance, to the United States), also includes

information on the company that exported the good (say, for example, from China), then we can manipulate data and obtain additional information beyond the Americas.

We carried out consultations with Trade Atlas Market Manager CK Zhera title, about whether we could propose a project where analyses would be generated based on Trade Atlas data; and then these analyses be made available (for free) at a public university website or blog? Trade Atlas representatives answered that they would be happy to support your project; and to further evaluate our suggestion in further detail and inform us whether and how we may support you.

Subscribing to the $1950 World Package including world data to expand on the Pilot Project, was also considered. However, the world package also has a limit of 15 HS codes and each additional code has a price of $100 USD. But in case one requires very extensive amounts of data, Trade Atlas can provide a more tailored solution. They suggested we inform them about how many HS Codes we would be needing in a given year so that they could set a price. However, the biggest drawback was that findings generated from data analysis (both for the Americas and World packages) that include company names are not publishable in academic articles with reference to Trade Atlas. Trade Atlas requests to not include company names obtained from these data, since each country and company has a different approach to and legal norms about publishing of such data. This matter makes it unfeasible to utilize Trade Atlas as the main source of data for the Online Service.

As an alternative, Import Key allows researchers to include company names in academic publications. In addition, analyses based on Import Key data can be made available (for free) at a public university website or blog, as long as we include in writing their name and website url there. So, at the outset, it is a better alternative. We then asked whether they offered a service whereby we could download and analyze data and make it available for a small fee to small and medium enterprises; in other words, resell analyses based on the data downloaded from Import Key? They informed us that they allow resale, but by that Import Key meant that if we brought in customers that could subscribe to their database, they would give us a 30% commission. That alternative is not feasible for our project because we want to analyze data from several databases, integrate and make it available to SMEs, not that SMEs directly purchase Import Key's subscription packages. When asked about other alternatives, Import Key representative stated that if we needed to download data and sell to other people, we could also do that, but didn't specify how that could work.

We also explored feasibility components for the "Online Trade Data Service for SMEs and Humanitarian Resilience", at the University of Puerto Rico. When asked about whether it was possible to launch a website to house the Online Service, the Deanery of Graduate Studies and Research stated that every professor has a space on their departmental page to create a website. However, the detail with most cases is that they must have a designated person in the unit to create the page in the event that the teacher does not have the skills to create and manage the content for the website. Furthermore, that the University does not have technical support for these types of requests at Deanery. In principle, the Deanery stated that professors can channel their research initiatives through a website and place data relevant to their research there.

Concerning the feasibility of charging for the Online Service, the Deanery stated that in order to charge for this type of services, we must have an account assigned by the venue to do this type of transaction; and that funds would go directly to the institution and not the project. This type of account must be requested and managed within our unit.

In sum, all three options considered pose problems that make offering the Online Service through a university website not feasible. Further research would need to investigate private options

as an alternative. What is feasible at present is publishing research findings with company data information obtained from Import Key, through the university's website. Other databases would also need to be evaluated.

CONCLUSION

Pilot Project contributed preliminary findings that throw light into how to build resiliency. Among these the following stand out. The Caribbean constitutes an alternative supply chain network, along with Mexico, that have proved crucial under disasters, not only for companies but also for humanitarian relief organizations. The United States has also played an important role, utilizing Caribbean and Central American ports of receipt and of lading, as an alternative supplier network. Harmonized Codes for relief (9802) are important to understand responses to disasters.

Method has been improved by utilizing several resources to generate an integrated trade database for Puerto Rico and supply chains' maps/diagrams. Some surprising findings pinpoint Puerto Rico's role as an exporter of medicinal and pharmaceutical donations, a paradoxical fact in the context of atmospheric, telluric and pandemic disasters.

Feasibility components of analysis to launch the Online Service from a university website utilizing the Import Key and Trade Atlas database were considered. Preliminary assessment does not find that option feasible at this time. Nevertheless, the Import Key and Trade Atlas databases both include some information on Puerto Rico, and that allowed us to carry out analyses focused specifically on the Island. Major achievements were being able to generate integrated trade data analyses for Puerto Rico utilizing the USA Trade Online database and data from the US Census Bureau for the 2015-2020 period. In addition, being able to generate maps/diagrams that illustrate how method can be applied and also, supply chain maps for specific products. Further research is needed to evaluate other databases and develop method and integrated database more.

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