Big Data Analytics to Enhance Customs Performance: The Case of Jamaica

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Recent Headlines Relating to JA Customs

- Jamaica Customs Agency goes paperless
 - Jamaica Gleaner, 29 Feb, 2016
- Finance Minister Demands 40% More From Jamaica Customs
 - Jamaica Gleaner, 3 July 2016
- Customs reports over \$44-b in net revenue for Q1 (13% increase)
 - Jamaica Observer, 4 August 2016
- Customs crisis! Fears that Jamaica could lose revenue to other countries which charge less
 - Jamaica Gleaner, 30 October, 2016

Motivation for this Research

- Jamaica's lofty aspiration of becoming a global logistics hub and a logistics-centred economy has rested largely on the country's physical attributes physical attributes and natural endowments:
 - several deep, large natural harbours with short channels to open seas;
 - an advantageous geographical position in close proximity to the newly enlarged Panama Canal and astride the major East-West container shipping lanes
- Success will be dependent, among other things, on the quality of ship-related and logistics services delivered to international trade and shipping community
- World Customs Organization advocates less intrusive customs inspections under the revised Kyoto Convention
- Customs Administrations in developing country in **Problem** Itend with the circuit strained Optimization Problem, service quality a A Constrained Optimizeused revenue demand pressures of governments

Jamaica's Logistics Performance

The World Bank Logistics Performance Index (LPI - <u>http://lpi.worldbank.org/</u>) provides a comparative ranking of countries' logistics performance. One of the six components that makes up the overall Ranking Index is "*The efficiency of customs and border clearance*"



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Jamaica	Singapore	Netherlands	UAE/Dubai	DomRep	CostaRIca		
Overall LPI Rank							
70 th	5 th	2 nd	27 th	69 th	87 th		
Customs							
54 th	3 rd	4 th	25 th	80 th	110 th		
Physical Inspections							
75%	5%	3%	5%	29%	13%		

Jamaica's LPI Comparative Trends



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Research Question: Can Big Data Analytics improve efficiency and throughput of Customs Operations in developing countries by increasing the precision of targeted physical inspections?

Jamaican Customs

- Customs agencies exist for three major purposes:
 - The security and facilitation of international trade
 - Fair and efficient collection of revenue
 - Protection of public health and safety (World Customs Organization, 2013, p. 5).
- Customs Jamaica's mandates align closely with these (Customs Act 1941), and are achieved through:
 - Financial assessment and collection relating to imports
 - Interdiction and seizure of contraband
 - Passenger, baggage, cargo and mail processing
 - Detection and response to customs law circumvention;
 - Protection of Jamaica's industries, labour and intellectual property rights;
 - Protection of national welfare and security. (Jamaica Customs, 2015)

Jamaican Customs – Global & Domestic Challenges

- Functions becoming more difficult due to rapid changes in the operational environment
 - Increasing passenger and cargo volume
 - Variety of potential criminal infractions,
 - Increasing criminal sophistication and difficulty of infraction detection, and
 - Reduced government funding (International Monetary Fund, 2003).
- Increased demands on tax-payer funds are driving government operations' increasing refinement of business operations models
- As an Executive Agency, adopting high performance standards, focused on performance improvement through increasing outputs per dollar of tax-payer funding

Jamaica Customs - Data-driven Opportunities

- The World Customs Organization (2013) has identified several strategies for the achievement of performance improvement:
 - Information sharing and cooperation, which underpin the extraction and processing of data from the customs supply chain.
- Customs' purpose depends upon intelligence, and current business intelligence is derived from traditional law enforcement techniques relying upon traditional data sources, management, and analytical techniques.
- A wide variety and volume of data (i.e. big data) available provides a potential opportunity for customs managers with the insight necessary to fulfil customs' purpose.
- This opportunity comes from many varied sources of data, accessible via the many partners in the customs' supply chain, if they are integrated.

Big Data – What is It?

Big Data generally refers to "a collection of data sets so large and complex that it becomes difficult to process using typical database management tools or traditional data processing applications"

- **Volume:** Incredibly large volumes of data are being generated each day, hour, minute from a variety of sources
- **Velocity:** With the increasingly digital nature of human, social and business interaction, a lot of big data is being generated in real-time
- Variety: The degree of diversity and complexity of big data arises from the multiple sources of data from inside and outside the organization such as social media tweets, Facebook likes, mobile and video content, which dwarfs the traditionally highly structured relational (tabular) data
- **Vastness:** Big Data tends to be exhaustive in scope, capturing the entire target population rather than a subset

(Gandomi & Haider, 2015)

- There has already been considerable interest in applying big data analytics techniques to the customs domain in the literature
- Geourjon et al. (2013)
 - Under Kyoto convention WCO recommends that intrusive customs inspections be limited.
 - Will improve efficiency of customs
 - Most modern customs administrations rely on risk analysis for this
 - Developing countries have been slow to adopt
 - Developing countries are still very much dependent on human judgment, which represents a major shortcoming, given moral hazard
 - Applied data mining and statistical scoring techniques to asses risk and assign declarations to various inspection channels in Senegal
 - These risk analysis methods have been used successfully in many other sectors (banking, insurance, security, etc.) so can be adapted to the context of customs

- Cantens et al. (2013)
 - The aim of applying analytics in customs and tax reform should be to help an agency improve its *effectiveness* while optimizing its *efficiency*.
 - For tax authorities, *effectiveness* means collecting to the extent possible the amount of revenue that is due according to the tax base and rates.
 - The *efficiency* of border procedures is known as *trade facilitation* in customs jargon.
 - Trade facilitation entails simplifying border regulatory controls to reduce unnecessary impositions on traders while recognizing that some customs controls are necessary and mandated by policy makers
 - Ultimately, trade facilitation is measured by trade transaction costs and the length of dwell times of goods at borders

- Digiampietri et al. (2008)
 - Globalization and increasing amounts of imports and exports have been used to conceal several illicit activities (e.g. tax evasion, smuggling, money laundry, and drug traffic)
 - Paramount for governments to find automatic or semi-automatic solutions to guide the customs' activities in order to minimize the number of manual inspections of goods.
 - Given the limited amount of available resources, it became impossible to inspect all the customs operations and identify all frauds.
 - Data mining and statistical approaches are being applied to identify fraudulent operations in other domains (e.g. credit card fraud, telecommunications fraud, terrorism detection, financial crime detection, and computer intrusion detection).
 - Explores whether the same techniques used can be applied in the customs domain

- Raballand (2013)
 - Uses statistical techniques to identify sectors where the likelihood of customs undervaluation (or overvaluation) is the highest in Cameroon.
 - Allows customs officers to better develop their risk management policy and implement cargo selectivity.

Measurement [and Anaytics], for purposes of reform, should not be "copied and pasted" from one country to another. Due consideration must be given to the varying aims of the customs service and the specific political, social, economic, and administrative conditions in the country - Cantens et al. (2013)

Early Propositions (Assertions?)

- 1. Through the context-specific application of data analytics, trade facilitation and revenue generation do not have to be dichotomous.
 - Effectiveness and efficiency can both be achieved through data analytics
 - Effectiveness = trade facilitation
 - Efficiency = Revenue
- 2. Risk Analysis models will have to include locally sensitive parameters in order to be effective.
 - Nuances specific to the region that will have to be considered.
- 3. Customs Inspection is only a part of the inefficiency of the trade facilitation value chain
 - Initial assumptions often focus the entire solution on reducing inspection without compromising revenue collection

Research Question: Can Big Data Analytics improve efficiency and throughput of Customs Operations in developing countries by increasing the precision of targeted physical inspections?

<u>UWI-MSBM</u>	Jamaica Customs
Research Program design	Survey Respondents
Source Research Funding	Access to Data (Anonymized)
 Technical Expertise 	– ASYCUDA
 Data Mining, Big Data Analytics, Open Source Data Integration Technologies 	 — Single Window Trade Facilitation
 Survey Design 	Access to Domain Expertise
Student Resourcing	Access to Partners
 Oversee prototype modelling and dashboard development 	 Port Authority, Port Community Identify/Specify business
 Production of Academic and Practitioner-oriented outputs 	challenges/issues amenable to Analytics

Sources of Data – Triangulation (Mashups)

