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Increasing the Value in Use of Open Government Data in Small Island Developing Economies

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1 Introduction

There can be great opportunity and economic value to be derived from recognising and treating Government Data as a valuable, re-usable economic asset. The data generated by governments is one of the few resources that is characterized by abundance rather than scarcity. It is increasing every day through the normal day to day business of governments doing what they do, and has the unique characteristic, unlike natural raw materials, of not being diminished when consumed (Moody & Walsh, 1999). Indeed, the value of data as an economic resource, increases with use and re-use. According to Nigel Shadbolt of the Open Data Institute (ODI) “Making the best possible use of an existing and increasing resource is not just common sense, it is the closest we can get to generating economic winners without losers.”¹

Given the social, political and economic benefits that can be gained through the sharing of Government data, the question becomes *why Governments of the Caribbean, small island developing states with limited economic resource endowments and persistent growth challenges, are not enthusiastically embracing these opportunities?*

In a region where small island developing economies struggle to cope with the lingering effects of the economic recession, tight fiscal space, limited economic policy discretion, and fiercely competitive political democracies, investment in Open Government Data initiatives contends with a range of other socio-economic policy demands for scarce resources and political attention. In such circumstances, the considerations for data initiatives and its potential economic impact requires greater specificity, more targeted focus and contextual relevance.

Our goal for this study is to encourage the value-in-use of large, specific, focused, contextual government data sets of the Caribbean by proposing and evaluating specific initiatives that lead to greater impact in this region. Given that the data, in many cases, already exists, the

¹ <http://www.msbmreview.biz/blog/making-sense-us3-trillion-%E2%80%93-estimating-value-open-data-small-economies>

focus will be on the Uptake and Impact phases of the value-chain. More specifically, in this study we will explore the Data Value opportunities for the Caribbean using Tourism and Agricultural data, two sectors critical to the social and economic well-being of the region.

The remainder of the paper is structured as follows. Section 2 examines some of the literature that was used to frame this research. We examine the field of Infonomics and more specifically the approaches to associating a value to data assets, we then discuss the literature associated with valuing Open Data and the estimates that have been provided. This discussion is followed by a description of the Data Value Chain and a justification for why we have chosen to focus on the Uptake and Impact stages of this value chain. Given we are specifically interested in Small Island Developing States (SIDS) and more specifically Jamaica, we provide some context and identify the sectors that are critical for this country, and likely other SIDS. In Section 3 we describe the proposed methodology to valuing sector specific Open Data Government data assets and identify critical sector levers. Section 4, provides an illustrative example and finally, in Section 5 we conclude with the main insights and consideration for future research.

2 Literature Review

2.1 Infonomics

As the value and opportunities of data grows, organizations are recognising their data is one of the most valuable assets, yet many are not managing and treating it as such. In order to ensure that this asset is treated with the priority it deserves, its value should be ascertained.

There are several approaches to associating a value to these data assets. Schmarzo (2021) discusses the importance of focusing on the economics of data and analytics and posits that economics is the language of business so if data and analytics are going to be taken seriously by executives, then they need to be discussed in the executive's language. He also speaks to the fact that data can be reused, and when shared and reused across multiple use cases the Economic Multiplier Effect (Schmarzo, 2021) can be achieved.

Infonomics is the discipline of managing and accounting for information with the same or similar rigor and formality as other traditional assets and liabilities. Infonomics posits that information itself meets all the criteria of formal company assets, and, although not yet recognized by generally accepted accounting practices, increasingly, it is incumbent on the organization to behave as if it were if they are to optimize information's ability to generate business value. There are three principles of infonomics: information is an asset; information has both potential and realised value and finally, the focus of this paper, is that information's value can be quantified.

In attempting to value information assets, one must observe some uniquely distinctive characteristics that distinguish Information assets from other economic goods. Among these are the following attributes (Moody & Walsh, 1999):

The Value of Information Increases with Use (see Figure 1): The major cost of information is in its capture, storage and maintenance— the marginal costs of using it are almost

negligible, so that it exhibits increasing returns to use. Information that is perpetually stored but not used, eventually becomes an organizational liability.

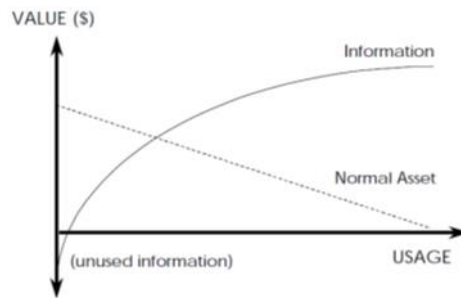


Figure 1 - Value of Information Increases with Use (Moody & Walsh, 1999)

Information is Perishable (see Figure 2): Like most other assets, the value of information tends to depreciate over time for a variety of reasons including being superseded by additional or more current data (e.g. customer information such as address or email changes), users unaware that the information exists, and the inability to access the information due to access rights or ineffective Metadata standards. The rate of depreciation depends on the type of information and the type of value consideration. For instance, when customer address information changes, the old address has little operational value in terms of contacting the customer, however it may still have analytic value in terms of sales demographics and other types of analytic models. In terms of Know Your Customer (KYC) compliance requirements, a bank’s obligation for verification may be valid for up to five years.

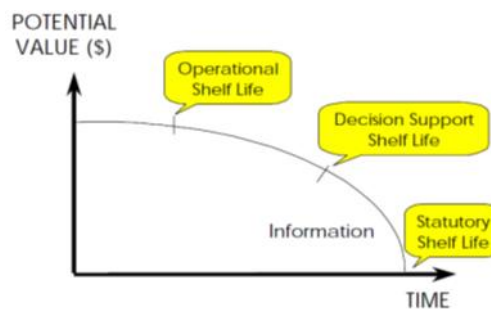


Figure 2 - Information is Perishable (Moody & Walsh, 1999)

The Value of Information Increases with Accuracy (see Figure 3): In general, higher quality information is, more useful and therefore more valuable, whereas inaccurate information can be very costly to an organization in terms of both operational errors and incorrect decision making. It is also worth noting that there is a point of diminishing marginal returns to quality, where expending resources on increasing information accuracy further provides little additional benefit, so data quality standards should be set at pragmatic levels rather than striving for 100% accuracy. A corollary attribute is that Information generally becomes more valuable when it can be compared and combined with other information through integration across a wide range of different operational systems and sources. Thus, the quality of a relatively small set of important data items for integration purposes (e.g. Customer/Citizen identifiers) can significantly impact the analytic benefits/value of integration.

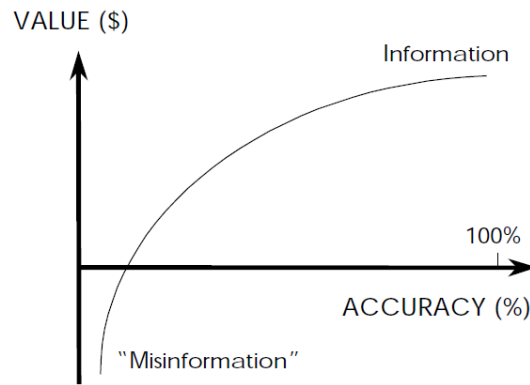


Figure 3 -Value of Information Increases with Accuracy (Quality) (Moody & Walsh, 1999)

Moody & Walsh (1999) also suggest three alternative measurement models for assessing the value of information:

Cost (Historical Cost) (see Figure 4): This is the traditional cost accounting approach to valuing assets based on how much was originally paid to acquire the asset (purchase price or development cost). Considering Data as the raw material, Software and hardware as the plant & equipment and Information as the end product, this method would require an assessment of the costs of the various hardware / software components of the organization's IT Infrastructure, as well as the operating costs associated with the ongoing collection and processing of data. The major advantage of this method is that it is the easiest to collect, and the least subjective method of value assessment. However, it likely will not reflect the current value of Information assets.

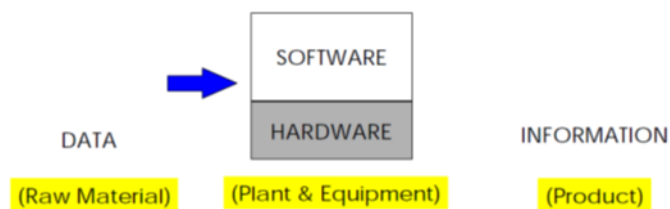


Figure 4 - Cost

Market (Current Cash Equivalent): Using this method, an asset is valued based on how much other people or organizations are prepared to pay for it. One conceptual method⁷ proposed for this value assessment is to determine the market value of the business (i.e. share capital), then assess how much an independent third party (such as a potential buyer) would value the organization if it was offered without the historical information about its products, customers, staff, and risk. Informal estimates suggest this drop in market value could range from more than 50% to less than 30%, depending on the information intensity of the organization (consider for instance, Amazon's market value without its data assets).

Utility (Present Value): this method estimates the value of the information/data assets based on the net present value of expected future economic benefits. Theoretically, this is the best indicator of the value of information because it takes into account the important principle of "Value of Information Increases with Use". However, it requires considerable managerial judgment and is highly subjective and difficult to estimate. It is often more practical to apply

this method in the cost-benefit analysis of future business value to be derived from the discrete strategic use of distinctive data/information assets.

For this paper, we will focus on applying the Utility approach, which will require an estimation of the future value of data derived from a discrete strategic use-case.

2.2 The Value of Open Data

The use, and in particular the re-use, of data across the economy underline the importance of data as a new form of capital for 21st-century knowledge economies (OECD, 2019). Data is an asset that cannot be depleted (Moody & Walsh, 1999) and because of this there is a great deal of opportunity for data to be used and re-used to generate benefits across sectors and societies that were not considered when the data was first being produced. This has led to government initiatives that have made public-sector data more openly accessible and free of cost to users. This data sharing has enabled data-driven innovation across economies, especially in cases where data linkages are identified, as data can increase in value when combined with other data (Moody & Walsh, 1999). OCED (2019) report that “studies suggest that data access and sharing can help generate social and economic benefits worth between 0.1% and 1.5% of gross domestic product (GDP) in the case of public-sector data, and between 1% and 2.5% of GDP (in few studies up to 4% of GDP) when also including private-sector data”. PIRA (2000) estimates that Public Sector Information (PSI) is valued between EUR 28 billion and 134 billion per annum or nearly 1% of the EU GDP. This estimate was derived by assessing how much the government invests in the acquisition of public sector information and the value added by users.

Although valuing data assets, generally is important, for the purpose of this study, the focus is on Open Data, specifically *Open Government* data. The rationale being that Open Data strongly exhibits the economic multiplier effect emphasized by Schmarzo (2021) because of the opportunity that it creates to share, re-use and integrate data across multiple contexts. Quantifying the benefits to measure the economic impact of open data is complex because the most important and significant benefits are indirect. There are a number of estimates in terms of the value of Open Data (Chui et al., 2014a, 2014b). Chui et al. (2014b) state that Open Data has the potential to transform every sector of the economy and reap annually more than \$3 trillion in global economic value. However, they point to the important role that Government must play if this value is to be realized. Huyer & Knippenberg (2020) estimate the Open Data market size at €184 billion and forecast to reach between €199.51 and €334.21 billion in 2025. In terms of economic gains from opening government data estimates vary from €40 billion a year (Zeleti et al., 2016) to €76 billion for the European annual market by 2020 (Wang & Shepherd, 2020).

In their study of the estimated market size of Open Data, Huyer and Knippenberg (2020) offer some insights for maximising the value of this open data. These insights include (i) ensure that open data re-users are aware and capable of understanding and leveraging the potential of the data (ii) focus on sector-specific initiatives and collaboration in and across private and public sector and (iii) look for opportunities to combine open data with personal, shared, or

crowdsourced data as this is vital for the realization of further growth of the Open Data market.

2.3 Data Value Chain

The Data Value Chain (Open Data Watch, 2018) provides an extremely useful lens for identifying opportunities for improving the impact and ultimately the value of Government Data. It describes the process of data creation and use from first identifying a need for data to its final use and possible reuse. The Data Value Chain has four major stages: collection, publication, uptake, and impact, where uptake/impact ultimately leads to value (see Figure 5). Many regional Open Data initiatives put the emphasis on the collection and publishing of data with the assumption that whatever is published will be used.

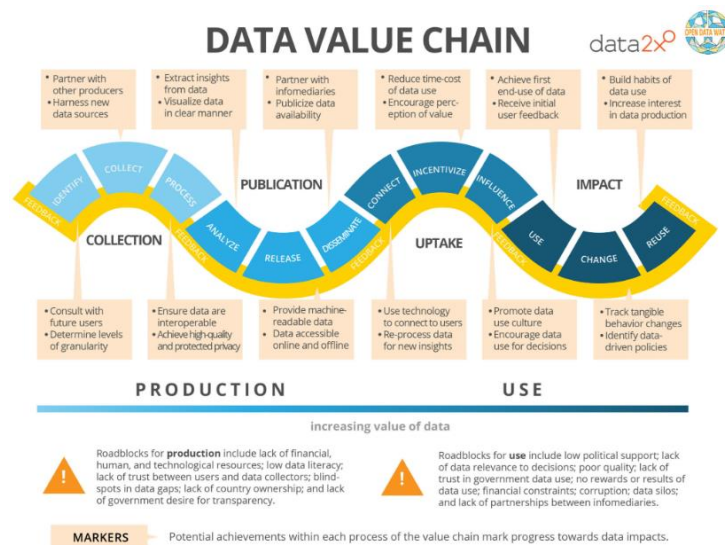


Figure 5 - Data Value Chain

However, the literature suggests that collecting and publishing data alone does not ensure they will be used or lead to positive impacts (Open Data Watch, 2018). While data dissemination is important, given data are inherently a public good, once they have been produced, they can be used and reused at little cost, generating value each time. Therefore, more attention should be placed on using and reusing data to their maximum effect, thus the need to place more emphasis on the Uptake and Impact stages of the Data Value Chain. The value chain demonstrates the steps and activities that can be used to achieve this. Uptake involves three main activities, connecting data to users; incentivizing users to incorporate data into the decision-making process; and influencing them to value data. Impact also involves three main activities, using the data to understand a problem or make a decision; changing the outcome of a project or improving a situation; and reusing the data by combining them with other data and sharing them freely.

2.4 Critical Sectors for Small Island Development States: Jamaica

One of the important critical success factors in treating data as an economic asset is to ensure executive buy in and one way to achieve this is through the demonstration of impact. The focus must therefore be on domains and areas the government sees as priority for

development and economic growth. Many of the well-documented examples of economic estimates of open data value (e.g. the transportation sector) may not be as applicable to governments of Caribbean Small Island Developing States (SIDS). Therefore, to demonstrate the economic value of data the first step must be to identify the sectors that the government sees as being critical to economic growth (e.g. Tourism, Agriculture, Fishing).

A study was conducted in Jamaica to understand the open data economic potential for three critical sectors of the Jamaican economy – Agriculture, Tourism and Education (McNaughton, 2013). A combination of analytically derived scaling and discount factors were used to project the open data estimates from global studies to the size of the Jamaican economy. Overall, it was estimated (conservatively) that Open Data initiatives in these three sectors could add over J\$15 billion in aggregate, annually to the domestic economy, approximately 1% contribution to GDP. For a country that has rarely seen better than 1.5 to 2% GDP growth in the last several decades, and negative growth in many instances, this is a significant impact. This demonstrates the need for identifying data value opportunities that could be derived from focusing on sectors that are often overlooked as they are considered region specific. The findings warrant further investigation in terms of realising this value.

Tourism as a target sector is rarely mentioned in the global data discourse, although it represents for most Caribbean countries the most important contributor to their economy, in some cases more than 50% of GDP. Given that effective access to information provides the primary basis for awareness, choice, and improved service delivery between the prospective tourist and local operators, tourism presents genuinely interesting and relevant opportunities for impactful Government Data Sharing applications.

There is some research that has discussed and demonstrated the opportunities for Open Data and technologies in the tourism sector (Pantano et al., 2017; McNaughton et al., 2020; Kalvet et al., 2020; Pesonen & Lampi, 2016; Yochum et al., 2020; Wolfert et al., 2017). Pantano et al. (2017) explore the use of open data analysis on the tourists' process of selecting tourist destinations and/or services. More specifically they seek to predict travellers' attitudes toward a tourist attraction by transforming large amounts of open data into value propositions. McNaughton et al. (2020) consider the opportunities for citizen-generated data as it relates to community-based tourism. Yochum et al. (2020) provides a review of the linked open data initiatives in location-based recommendation systems for the tourism domain.

The agriculture sector is seen as one of the most important sectors in an economy due to its impact and influence on other sectors and people's day-to-day life. The sector is facing several challenges, such as climate change, food security, and population growth. One approach to addressing these challenges is through the use of technologies and data. There have been several initiatives that have recognised the importance of the adoption of technologies and data to the agriculture sector. The Global Open Data for Agriculture and Nutrition (GODAN)² is an UN-backed initiative aimed at driving global efforts to tackle food security and end world hunger by propagating open data policies in agriculture and nutrition across the planet. Innovative tools can be developed through the access to agricultural data

² <https://www.godan.info/>

(Romani et al., 2023; Qin et al., 2022; World Bank, 2013). An example open agricultural data innovation is the Frais et Local open data portal which helps boost domestic consumption as consumers can find the closest local producers of farm products, anywhere in France and its overseas territories³.

Musker & Schaap (2018) conducted a survey of the partner organizations of GODAN to determine open data activities, including challenges, use of open data, stakeholder involvement and future directions. They found that the most common challenges were those around the data itself including how to access it, manage it, and how to keep the sensitive data secure. Therefore, the focus on the Data Value Chain is important in getting to the goal of increasing impact and thus value using agricultural open data.

The agricultural sector forms an important part of Jamaica's productive capacity, contributing on average 8.1 percent of GDP in 2022⁴. The value added by the agriculture, forestry, and fishing sector to the GDP in Jamaica reached a peak in 2022 with 1.2 billion U.S. dollars⁵

There is typically a strong link between the Agriculture and Tourism sectors, as an example, approximately 30% of the total food purchases in the Tourism sector in Jamaica come from domestic Agriculture, with the rest being imported. Effective use of Open Data about the demand and supply of agricultural produce can be used to facilitate increased linkages and increase the economic multiplier effects between Tourism and Agriculture.

The Minister of Tourism in Jamaica has emphasized the need to look at the link between Agriculture and Tourism (Ministry of Tourism and Entertainment, 2015). He has pointed out that tourism is a huge driver of foreign exchange. He noted that Jamaica's Tourism sector contributed 10% to the GDP. The earnings from the sector across the Caribbean represented more than 50% per cent of the foreign exchange generated. (McIntosh, 2021). However, he noted that the sector currently has a high dependence on imports and a substantial amount of this is for fresh fruits and vegetables. Currently, the local agriculture industry can only supply 20% of the demand. He called for a focus on exploring how agricultural supplies are sourced to meet the demand for Tourism. Open Data and technologies can be used to help address this issue.

3 Methodology

This study adopts the Utility/Value in Use (Moody & Walsh, 1999) approach described above where the cost-benefit analysis of future business value is derived from the strategic use of distinctive data/information assets. Relating this back to the Data Value Chain this supports the need to focus on the Uptake and Impact stages of the Data Value Chain.

The Value in Use approach states the focus should be on the *strategic use of distinctive data/information assets* and therefore it is important when applying this approach to identify

³ <https://www.fraisetlocal.fr/>

⁴ <https://tradingeconomics.com/jamaica/agriculture-value-added-percent-of-gdp-wb-data.html>

⁵ <https://www.statista.com/statistics/1079607/jamaica-agriculture-value-added-gdp/#statisticContainer>

domains of critical importance to the country/institution adopting it, and furthermore that it be applied at the strategic level.

3.1 A Framework for Assessing the Value in Use of Open Government Data

Granickas (2013) provides a useful synthesis of the literature and related research efforts to understand, structure and measure the impact of releasing and re-using Open Government Data. He suggests that while there is still a need for a consistent economic impact methodology, the key issue is to understand how opening and re-using data can bring about economic, political and social benefits and who are the key stakeholder beneficiaries (i.e., Government, Private Sector, NGO's/civil society).

Similarly, Jetzek et al. (2012) derives from the literature, a useful analytic framework for assessing the value of Open Government Data that identifies four key value propositions: *Transparency, Participation and Collaboration, Public sector efficiency* and the *Creation of new businesses*. Transparency in the public sector provides citizens and other stakeholders with a window into the operations of the government which encourages due process and fairness and the public scrutiny of wasteful behaviour in public-sector organisations. This benefit is also valuable for the public sector itself as transparency can create trust in public operations.

Open Data and the use of Information Technology allows for citizen participation and collaboration in the delivery of public service. For example, the Web and SMS-accessible platform called the Public Participation Information System (LAPOR), launched by the Government of Indonesia in 2011 lets citizens monitor and verify the delivery of government services in real time (Dini et al., 2018). Public sector efficiency and effectiveness is strongly facilitated by digital or e-government activities where the goal is to modernize and streamline government with the help of information technologies. By opening government data, efficiency can be increased through consolidation of overlapping repositories, improved information infrastructure, inter-agency coordination and better financial controls.

The 4th value proposition identified by Jetzek et al. (2012) is the creation of new businesses and services. Organizations outside of the public sector have an opportunity to use Open Government Data to create new services ultimately leading to economic growth. Many examples exist in the emerging App Economy (Mandel, 2012) to illustrate how Open Data drives growth by stimulating the creation of firms that reuse freely available government information in innovative ways. Insights derived from the use of open data can raise productivity, enable innovation, and replace traditional structures, all of which contribute to the creation of new entrepreneurial opportunities.

Further explicating these four key value drivers, Jeztek's analytic framework highlights varying degrees of collaboration between public and private sector interests, as well as a continuum in the degree of economic and social value, as important variables in assessing and situating the impact of open data initiatives (see Figure 6).

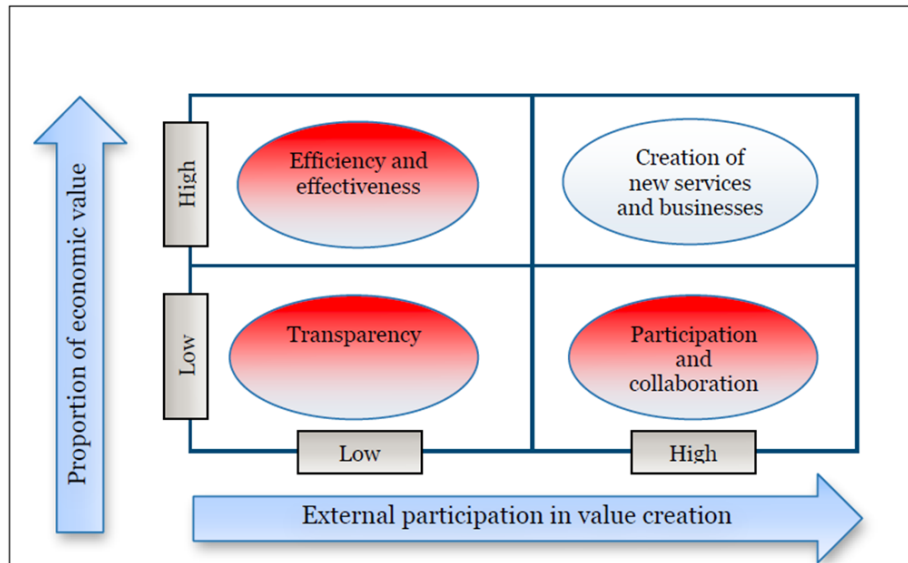


Figure 6 - Value Drivers of Strategic Open Data Initiatives (Jeztek et al, 2012)

We combine the insights from both studies (Granickas, 2013; Jeztek et al., 2013) to derive Table 1 which summarizes the key potential benefits of opening and re-using open government data and the likely beneficiaries (G-Government, P-Private Sector, C-Civil Society/NGOs). The table illustrates some notable insights:

- i. Although Open Government Data had its genesis in the Political agenda (transparency/accountability) the economic and social benefits have begun to dominate the open data discourse.
- ii. Governments themselves, stand to be significant beneficiaries from Open Government Data initiatives as do Civil society and the Private sector.
- iii. Several of the benefits of Open Government Data are shared benefits, which encourages a participatory approach to realizing these benefits through enhanced Government, Private sector and Civil Society engagement & collaboration.

Table 1 - Potential Impact of Open Government Data

Jetzek et al. (2012)	Granickas (2013)			Beneficiaries
	Economic	Political	Social	
TRANSPARENCY		Increased transparency & accountability Facilitate Access to information	Better informed monitoring of government actions Increased protection of Access to information	CG C C
PARTICIPATION & COLLABORATION	Innovations in public service delivery	Increased Civic participation & engagement	Increased inclusion and empowerment	C CG CG
	inter-agency coordination/data sharing in Government	Increased Political awareness & participation	Civic participation	G GC CG
	Crowdsourced or delegated services to private sector.	Generate new kinds of Public-Private partnerships	Support personal decision-making capabilities	GP GP C
		Reduced asymmetry of information/knowledge	Encourage release of private business data Enrich policy debates and policy formation	CG CG CG
EFFICIENCY & EFFECTIVENESS	Increased efficiency in public services	Increased efficiency in public services	Increased efficiency in public services	GC G GC
	Increased tax revenues (increased economic activity)			GC
	Reduction in data transaction costs			GP
	Increased service effectiveness through linked data			GC
	Reduced costs for data conversion			PG
CREATION OF NEW SERVICES & BUSINESS	innovation/entrepreneurship drives new businesses		Increased sustainability potential for NGOs through increased capacity / service opportunities	PG C
	New services / goods based on Open Data			PG
	Better decision-making based on accurate information			PG
	Increased GDP through expanded economic activity			GP
	Stimulate Knowledge economy growth			G
	Better-skilled workforce (knowledge workers)			PG
	Enable transformation in specific sectors (eg. Finance)			P
	Disrupting traditional business models			P

3.2 The Benefits of Open Data in Tourism and Agriculture

The popular McKinsey report (Manyika et al., 2013) underscores the usefulness of quantifying the potential value of using open data in specific “domains” of the global economy, rather than as a general-purpose Government initiative, an approach which also lends itself to benchmarking and cross-country comparisons. The McKinsey study utilizes the concept of “*levers*” (or drivers) as a means of identifying ways in which Open Government Data can enable potential value. The identification of levers, allows for separating the qualitative “*how*” from the quantitative “*how much*”, and provides a convenient mechanism for explicating, evaluating and illustrating the potential value impact of Open Government Data.

We employ our derived framework (Table 1) as a guide to identifying sector-specific levers through which the economic value of open data can be exploited in key sectors of the Jamaican economy. These qualitative levers are then used to identify opportunities to unlock value using open data and estimate how much annual value to the economy each lever might help enable. Using this approach, the following levers were identified for the Agriculture and Tourism sectors in Jamaica (see Table 2 and Table 3), and categorised according to efficiency and effectiveness, participation and collaboration, transparency, and creation of new services or business.

Table 2 - Levers for Agricultural Sector

Category	Levers (Drivers)
Efficiency & Effectiveness	<ul style="list-style-type: none"> • Improved logistics in the agricultural sector to mitigate spoilage, surplus and shortages – as the agriculture industry in Jamaica suffers from logistics and coordination problems especially in times of drought and glut, efficiency of crop production planning and distribution can be enhanced with the use of an open data platform that can electronically match demand to supply. Aggregate demand estimates could be derived from the needs of large consumers such as Agro-processors, the hotel industry and restaurants, combined with historical retail consumption patterns. Supply could be forecast from Agriculture production data captured by the Rural Agricultural Development Authority’s (RADA) Agricultural Business Information Systems (ABIS) system together with current food imports and import licences. • Improved analysis of agricultural information to inform policy – as the Ministry of Agriculture tries to increase local production, local consumption and export, to ensure that there is no over-production which leads to wastage and underproduction which may drive prices upward, this increase in agricultural production planning must be data driven. Access to accurate agricultural data on consumption, production potential, time for crop maturity etc. is crucial to ensuring that additional demand is met. • Enhanced access to geospatial information – with free access to geospatial information farmers can adhere to farming best practices by knowing where, and when to plant both for optimal yield and environmental preservation.

	<ul style="list-style-type: none"> • Open meteorological data – as the agricultural sector remains highly susceptible to weather conditions and natural disasters, open data can facilitate reduced losses during times of devastation by providing farmers with timely access to information on major disasters and also changes in weather patterns such as heavy winds or flash floods. Access to historical meteorological data can also help Extension officers to guide farmers in the planning phase as to where to plan and when and what crops are suited for particular areas based on meteorological patterns. • Efficiency in the delivery of Extension Services – RADA is continually challenged with providing sufficient resources to extension services to address the support demand of farmers across Jamaica. The effectiveness of the individual extension officer can be enhanced using Open Data combined with mobile Apps which can provide field-based decision support and information access to both aggregate and individual agriculture data stored within Government production systems. Typical functionality could include: on-demand data access to farm, crop and price information and location-based searching using the mobile phone’s built-in GPS capability.
Participation & Collaboration	<ul style="list-style-type: none"> • Data accuracy, currency, scale, completeness – the efficiency, quality and timeliness of data collection on agriculture production, prices and location is a challenge to effective planning, oversight and decision-making in the agriculture sector. Open Data and crowd-sourcing mechanisms can lead to improved accuracy and currency of data by mobilizing a larger proof of end users to continue to the data collection and/or verification process.
Transparency	<ul style="list-style-type: none"> • Open access to business information to support farmers and retailers – numerous tools and products must be invested in livestock, fisheries and ground produce for a successful yield. The costliness of these inputs has always been a grave concern to the agricultural sector and at times undermines investment in the sector. Therefore, easy access to procurement information will help investors in cutting input costs. The facilitation of the comparison of supplier and retailer prices also increases the competition in the sector allowing the consumer to get the best price possible. • Reduction in the theft of agricultural products – with the implementation of livestock registration mechanisms (passport) the use of Open Data can provide “real-time” access to agricultural data that can enhance the oversight and traceability of products from the farms to the final consumer. Combining this information with crowd-sourced Open Data on incidences of praedial larceny can provide security forces with an improved detection and investigative capability to tackle praedial larceny.
Creation of New Services and Businesses	<ul style="list-style-type: none"> • Agriculture innovation ecosystem – the release of official Government agriculture data as Open Data creates the opportunity for the emergence of a variety of <i>e-Agriculture Apps</i> that can encourage a broad base of domain experts, technical developers, and innovators to participate in the building and evolution of an Agriculture innovation ecosystem. • Software Development and Services – published agriculture Open Data becomes a catalyst for innovation opportunities for software developers and service entrepreneurs. Currently, there are a few small-scale examples emerging of startup ventures that utilize

	<p>Agriculture price and production data production by the Ministry of Agriculture but a well-documented example of a successful Agriculture open data startup is the Climate Corporation⁶ which leverages climate and soil open data to develop insurance products to help farmers protect and improve their farming operations. Climate Corp raised over US\$100 in venture capital.</p>
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Table 3 - Levers for Tourism

Category	Levers (Drivers)
Efficiency & Effectiveness	<ul style="list-style-type: none"> • Improved quality of service delivery in support services such as transportation, entertainment and merchandising. For example, tourists to Jamaica who take the opportunity to venture beyond the confines of the all-inclusive package and explore the rich cultural immersion experiences that the island has to offer, will often need to be able to locate a variety of service providers such as transportation services, on-demand. Open Data enabled mobile Apps that can facilitate the ability to engage with licensed, reputable operators at the right price would be valuable from a security and service delivery perspective. • Enhanced tourism product information and diversity of choices for discriminating visitors with niche interests (e.g. Eco-Tourism). • Enhanced market analysis and selective targeting through access to tourism origin data. Although the Jamaica Tourist Board (JTB) currently publishes arrival statistics, publishing the raw data could stimulate Apps development, and enhance sector reporting, analysis and visualization to provide better data for tourist-related businesses to do targeted marketing and to plan and price their services better.
Participation & Collaboration	<ul style="list-style-type: none"> • Increased linkages between tourism and other sectors such as agriculture, manufacturing, arts and craft, self-employed service providers. Food and Agriculture Organization (FAO) studies estimate that only 30% of the total food purchase by hotels in Jamaica represent local purchases. Current efforts by the Ministry of Tourism to establish a Tourism linkages hub⁷, that plugs into the databases of related agencies such as the Ministry of Agriculture and Fisheries, RADA, Jamaica Promotions Corporation (JAMPRO), the Jamaica Business Development Corporation (JBDC), the Jamaica Manufacturers' Association (JMA) and the National Export-Import (EXIM) bank of Jamaica, can be significantly enabled/enhanced using linked Open Data initiatives. • Empower Community Tourism interests and stakeholders with greater participation and collaboration in the development of the community tourism product. Open Data initiatives can impact positively on the visibility, inclusiveness, and welfare of small operators, within the tourism sector and become an enabler for local communities to evolve into sustainable business enterprises (McNaughton et al., 2020).
Transparency	<ul style="list-style-type: none"> • Increased transparency in the allocation and disposal of resources/funds for the development of the sector (e.g. Tourism

⁶ <https://climate.com/>

⁷ <https://www.mot.gov.jm/page/tourism-linkages-network>

	Enhancement Fund; Jamaica Social Investment Fund – community-based tourism development etc.)
Creation of New Services and Businesses	<ul style="list-style-type: none"> • Increased visibility and clientele for small hotel properties, and attractions. Small lodging properties and individual service providers have traditionally had an inherent disadvantage when compared to larger properties and more established brands, due to lack of financial resources, organisational capabilities and visibility. Open Data approaches and technologies can provide enhanced, multimedia information channels that can facilitate increased visibility of small operators, as well as enhance the interactions between the various actors within the tourism community including the tourism agencies, transportation and other service providers, larger hotel chains, tour operators, etc. • Enable product development and market access for community-based tourism initiatives. • Innovation opportunities for software developers and other service entrepreneurs to exploit available Open Data to build service delivery Apps for guided tours, including planning, booking and transportation.

4 Illustrative Example

While we have identified several qualitative “levers”, each of which could be further analysed to provide an aggregate estimate of the value of Open Data in these two sectors of the Jamaican economy, for the purpose of this paper, we will further evaluate and estimate a single lever as an illustration of this approach. This is the amount of food consumption in Tourism that comes from domestic Agriculture *vs* imports as was highlighted in McIntosh, D. (2021). This is a particularly important issue for the economies of the Caribbean that are heavily Tourism-dependent, and for which Agriculture, Food security and Nutrition are critical social, economic and political issues. The perceived importance of this issue is evident in the establishment of a Tourism Linkages Network⁸ by the Ministry of Tourism to facilitate the strengthening of sustainable linkages between the tourism sector and other productive sectors of the economy — such as agriculture, manufacturing, and entertainment.

The economic importance is further reinforced in the Medium-term Socio-economic Policy Framework (MTF) and the Growth-Inducement Strategy of the Government of Jamaica (GOJ) (Hutchinson and Harris, 2012) that identified the development of economic linkages between the tourism sector and the other sectors of the economy, through the opportunities that exist in the local industries for import-substitution of demand by the tourism sector for food and other goods and services that are currently met by imports. A study by the World Travel and Tourism Council (2013), which estimated that 30% of travel and tourism spending in Jamaica leaks out of the economy through imports, supports this viewpoint.

An important reference study conducted by the Ministry of Tourism Linkages Hub investigated the economics of this issue in some detail (Ministry of Tourism and Entertainment, 2015). Among the primary objectives of the study were to:

⁸ <https://www.mot.gov.jm/page/tourism-linkages-network>

- Identify areas where there is strong opportunity for increased consumption of local goods and services in the tourism sector.
- Increase understanding of the supply chain for the tourism sector.
- Identify specific constraints and limitations hindering tourism linkage with the domestic economy.
- Estimate the value of leakages due to expenditure on imported goods and services.
- Determine the receptivity for use of local goods and services within the sector.

While the study examined the tourism sector demand for local goods and services across the agricultural, manufacturing and entertainment sectors, a summary of the key findings in relation to Tourism and Agriculture specifically are indicated in Table 4.

Table 4 - Value of Key Economic Indicators

Key Economic Indicators	Value	%ge Impact	
Tourism sector value		6.4% GDP	
Tourism sector labour force		7.1% workforce	PIOJ (2015)
Tourism sector foreign exchange earnings	US\$2.24B		PIOJ (2015)
Tourism Input Demand (Agriculture)			
• Locally sourced Products	J\$14.5B	74.5%	
• Poultry, Meats & Seafood	J\$10.9B		
• Fruits	J\$ 5.3B		
• Vegetables	J\$ 1.6B		
Estimated Annual leakage due to imports	J\$1.6B – J\$5B	8.5% - 25.5%	
• Processed foods	J\$1.13B	10%	
• Fruits	87M - J\$ 3.4B	2 – 64%	
• Vegetables	J\$ 14M	9%	

The annualized value opportunity as a result of leakages in the Tourism demand from Agriculture was estimated to be between **J\$1.6B and J\$5B**. The key factors highlighted that constrain the Tourism linkages with the domestic economy were:

- **Lack of capacity to supply in large quantities:** the small size of farm holdings limits their capacity to supply in the large quantities required in the hospitality industries.
- **Lack of consistency of supplies, and poor quality of products:** absence of centralized quality assurance of local agricultural products to ensure that standards set by the hotels and restaurants industry are met in relation to quality and consistency of supply.
- **Absence of available administrative data** to enable a more robust measurement and assessment of the linkages between the tourism sector and the local industries. The authors of the study lamented the lack of available secondary data and the reliance on limited primary data that necessitated the use of a simulation approach to estimating the national demand for goods and services and the leakages associated with imports.

These findings and challenges are visible symptoms of information asymmetry that we interpret through the lens of Open Data. Open Data recommendations for these issues are highlighted in Table 5.

Table 5 - Open Data Recommendations and Value Implications

Findings / Issues	Open Data Recommendations and Value implications
Lack of capacity to supply in large quantities	The efficiency of crop production planning and distribution can be enhanced with the use of an open data platform that can electronically match demand to supply. Aggregate demand estimates could be derived from the needs of large consumers such as Agro-processors, the hotel industry and restaurants, combined with historical retail consumption patterns. Supply could be forecast from Agriculture production data captured by extension services within the Ministry of Agriculture system together with current food imports and import licences.
Lack of consistency of supplies, and poor quality of products in the case of the agricultural sector	The effectiveness of the individual extension services provided by the Ministry of Agriculture to support farming practices, can be enhanced using Open Data combined with mobile Apps which can provide field-based decision support and information access to both aggregate and individual agriculture data stored within Government production systems. Typical functionality could include: on-demand data access to farm, crop and price information, production best practices and crop disease information and location-based searching using the mobile phone’s built-in GPS capability.
Absence of available administrative data to enable a more robust measurement and assessment of the linkages between the tourism sector and the local industries	<p>Sustainable measurement, assessment and improvements in sector linkages could be facilitated by “<i>plugging</i>” into the administrative databases of related agencies such as the Ministry of Agriculture and Fisheries, RADA, JAMPRO, the Jamaica Business Development Corporation (JBDC), the Jamaica Manufacturers’ Association (JMA) and the EXIM bank and can therefore be significantly enabled/enhanced using linked Open Data strategy.</p> <p>In addition, the authors recommend establishing a Tourism Sector Market Information System to monitor all hotels and restaurants that have capacity beyond a minimum level and collect information on agricultural products consumed at each property on a regular basis. This would be available as Open Data to facilitate independent research, analysis and tracking of demand linkages.</p>

5 Discussions and Conclusion

The reuse and combining of Open Data on Agriculture production, and Tourism consumption/demand, can significantly enhance the capacity to measure, analyse and track the extent of demand linkages between the tourism sector and other productive sectors of the economy — such as agriculture, manufacturing and entertainment. Given the estimated annual leakage due to imports of an estimated J\$1.6B to J\$5B, Open Data solutions such as those identified in this research can potentially provide a significant contribution to the national GDP. Although we have illustrated our approach using just one of several levers identified, the estimate of J\$1.6B to J\$5B of value that Open Data solutions can seek to

unlock appear to be well aligned with a previous study in Jamaica that was done (McNaughton, 2013) that estimated that Open Data initiatives in three key sectors (two of which we have considered) could add over J\$15 billion in aggregate, annually to the domestic economy.

The examination of this issue provides an important case-study of the key principles of **Uptake/Impact** stages of the Data Value Chain:

Uptake:

- i. **Connect:** Connecting data to users can include holding trainings, seminars or other educational events and improving the user experience and ease-of-use offered by websites and/or data portals. The Ministry of Agriculture in Jamaica currently has individual extension services to support farming practices. This can use Open Data combined with mobile Apps to provide field-based decision support and information access to both aggregate and individual agriculture data stored within Government production systems. The training initiatives increase the value opportunity of data by preparing users with the competency to use these data and applications.
- ii. **Incentivise:** Incentivizing users to incorporate data into the decision-making process can take many forms. Open Data policies within government, should mandate data producing agencies (e.g. Jamaica Tourist Board, Agricultural development Corporation) to publish and maintain open data repositories or offer additional budget support to do so. Training could be sponsored as these training initiatives increase the value of data by preparing users to use data and their applications. The annualized value opportunity (J\$1.6B to J\$5B) from leakages in the Tourism demand from Agriculture should provide sufficient incentive for government to focus on this in a very deliberate way.
- iii. **Influence:** Influencing users to value data. Data Training and Awareness are important in influencing users to value data. Identifying data advocates within agencies is also a useful approach to get the culture change needed to move to data driven decision making and valuing data.

Impact:

- i. **Use:** Using the data to understand a problem or make a decision. The Ministry of Tourism has recognised (Ministry of Tourism and Entertainment, 2015) the need to identify specific strategies to link local producers and buyers in the tourism sector as well as to strengthen the capacity of local suppliers to meet tourism sector's demands. An Open Data platform for matching demand to supply will clearly be an example of data-driven decision-making.
- ii. **Change:** Changing the outcome of a project or improving a situation. The Ministry identified a clear need for a mechanism for continuous collection of data in the tourism sector beyond what is currently being collected. They propose a more systematic Market Information System to address the needs of the different sub-sectors, particularly the hotels and restaurants industry in which more than half of the membership of the JHTA operates. Currently, there is too much reliance on surveys for primary data on tourism sector's demand of local and foreign products. This

availability of data will make it clearer for the Government to identify the source of leakage from imports.

- iii. **Reuse:** Reusing the data by combining them with other data and sharing them freely. Clearly, given the importance of sector linkages there are opportunities to be had from combining data from one sector with data from another sector. The Ministry report (Ministry of Tourism and Entertainment, 2015) has recognised that sustainable measurement, administrative assessment and improvements in sector linkages could be facilitated by “plugging” into the administrative databases of related agencies and can be enabled using a linked Open Data strategy.

We anticipate that this research will help to highlight the value opportunities in these key sectors, and encourage other researchers to use the levers provided to further estimate the value of Open Government data. The issue of credibility and context-relevance of the typical global open data estimates can be challenging for Governments in the English-speaking Caribbean, where economies are less than 1/100th of the size of the estimates (US \$'trillions). Furthermore some of the rationale (“levers”) underpinning the economic estimates in domains such as Transport, Consumer Products, Oil & Gas, Health Care and Consumer Financing can often appear meaningless, given the state of civil infrastructure and public service delivery in many of these countries.

By identifying and articulating value opportunities (“levers”) in sectors such as Tourism and Agriculture that are more familiar and relevant to the regional socio-economic discourse, our goal with this type of study is to help stimulate debate, inform the policy agenda and spur Caribbean Governments to embrace Open Data initiatives with greater urgency and commitment.

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