TOURISM AND INNOVATION:

Leapfrogging the Caribbean Private Sector

Presented to

Compete Caribbean

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COMPETE CARIBBEAN

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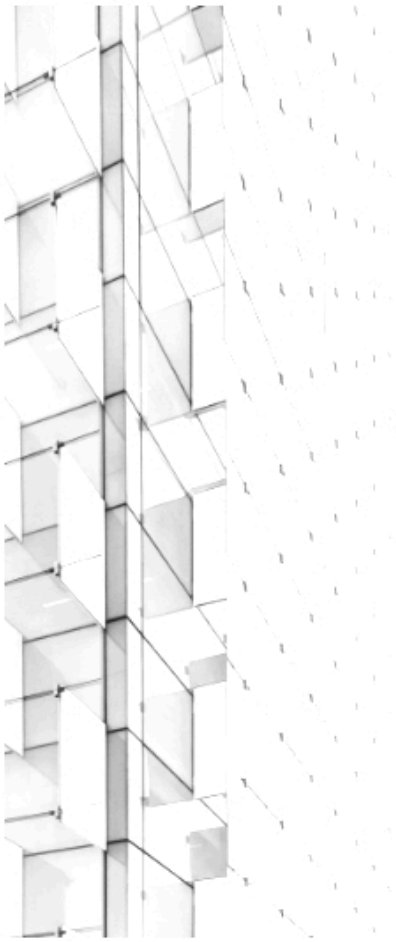

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EXECUTIVE SUMMARY

This consultancy was delivered for Compete Caribbean and endeavoured to develop a report aimed at recommending solutions that would assist the leapfrogging of the Caribbean private sector into the 4th industrial revolution. In doing so, this report aims to identify the challenges within the Caribbean tourism industry and the solutions that digitisation could provide. We use both quantitative data (firm-survey) to derive a Structural Gravity General Equilibrium Model, used to identify and calculate the effects of the biggest barriers to SME growth, as well as qualitative data (interviews) of real-life business cases, which can be used to tackle the said barriers. The report is laid out in the following manner.

Section 1 of this report provides an overview of the economies of the Caribbean Community (CARICOM), which are mostly comprised of SMEs and are dependent on international tourism. However, despite the fact that tourism accounts for 24% of GDP per island on average, this critical industry in the region has been experiencing a decline in the recent years, thus creating a macroeconomic slowdown. For this reason, raising competitiveness of the sector has become a crucial issue, for which this report identifies digitisation as an effective solution.

Section 2 comprises of a literature review of the discussions around development and digitisation, from which we derive the theoretical motivation of this paper. Here, we explore an empirical link between technology penetration and economic growth, as well as the theoretical role of technology in transforming patterns of knowledge and production. We find that digitisation is important to growth in that it creates positive knowledge spillovers across industries and that it brings previously excluded actors into the market. Finance-related innovations have shown particularly large impacts on SMEs, as will be discussed in the business case studies in section 4.

Section 3 discusses our quantitative empirical framework, in which we utilise a firm survey data to derive a Gravity Equation model for tourism in the Caribbean.The survey analysed (PROTEqIN) consists of firm-level data for 1,680 service-sector SMEs from 13 Caribbean territories, from which we identify the two biggest barriers of growth for SMEs: cost of finance and access to finance. Next, we model these barriers as price friction using a Structural Gravity General Equilibrium Model for Caribbean tourism. Tourism is considered an exportable service/good in this model. Using this, we find that the total cost of the price friction annually costs the Caribbean Community (CARICOM) 2.2% of its regional GDP, and that its removal results in a 12.7% increase in annual tourist arrivals. Given the strength of this impact, combined with the financial nature of the identified barriers, we explore three concrete financial technology innovations that can tackle these barriers in the next section.

Section 4 analyses the nature of the two identified barriers and identifies three real-life case studies of existing business innovations that can address the said

barriers. Our logic is that private sector innovation are both faster and more feasible in the short-term than macro regulatory changes that would require planning of longer-time frame .

First, we find that cost of finance in the Caribbean is extremely high, especially for SMEs, due to underdeveloped banking sector and overly conservative financial regulation regime. Digital payments options often require exorbitant fees, which blocks SMEs from the rest of the global market. The first case study, Bitt Inc.,utilises blockchain and distributed ledger technology for mobile money/wallet, as well as Central Bank Digital Currency (CBDC) for governments looking for innovation. Bitt's mobile money payment scheme allows a significantly lower cost of finance for SMEs in the Caribbean by eliminating the financial middleman. The second case explored is Trekksoft, a Swiss enterprise that offers a suite of online booking and payment solutions for firms in tourism. Trekksoft allows a radically simpler international digital payment process for local tour providers by connecting payment transaction details with the date/time data of each tour. The implication of this is that this simpler and faster payment model means greater working capital liquidity for SMEs, who often struggle from lags of payment but fail to find financing alternatives.

We also find that access to finance is an important issue in the Caribbean. Due to conservative regulations, banks often require impossible requirements and unfavourable loan terms to SMEs. The last case study, OmniBnk, tackles the access to finance barrier. OmniBnk is a Colombian company that provides invoice-backed financing to SMEs, powered by behavioural machine learning. OmniBnk uses alternative datapoints, such as invoice history data, for creating low-cost and efficient risk screening system for SMEs. OmniBnk's quick and relatively more flexible operation has given highly favourable access to finance to SMEs under a generally inflexible financial environment.

Section 5 comprises of our concrete policy recommendations as well as their inherent limitations. We recommend that the Caribbean policymakers actively engage in early experimentations with the budding technological innovations in the private sector, while creating an enabling regulatory environment. There are successful cases in both the developing and developed countries for the Caribbean to benchmark, such as Kenya's m-Pesa. Successful cases of public-private partnership schemes can also be learned and optimized for the Caribbean context for adoption. Nevertheless, all these efforts must be accompanied by an overall enabling environment for business. On the other hand, the market-based nature of these recommendations also generate limitations. First, private firms will not take private risks, if the general environment is considered unfavourable. Thus, a business-conducive environment and state support is a must. Second, private interests are not the same as public interests, especially with regards to privacy and data. Third, impact of business innovations would depend heavily on their scalability, especially in small, segmented economy like the Caribbean.

Finally, we close this report by arguing for a greater need for the Caribbean governments to strive towards creating a more enabling environment for the private sector, as well as directly promoting an innovation culture in public.

1. INITIAL REMARKS

Despite massive strides in both economic and political development in the 1980s, the Caribbean region has been suffering from a persistent economic stagnation in the recent decade (See: Alleyne et al., 2017 and Economist Intelligence Unit, 2015). GDP growth per capita has been slowing down[1], as well as revenues from tourism and services trade (IMF, 2013a). Several reasons for this downturn have been identified, including: high costs of financing and lack thereof, high labour costs, low productivity rates, high exposition to negative external shocks and inadequate financial sector, among others (See: Rasmussen, 2004; Ruprah et al., 2014 and Khadan, 2017).

1.1. The Caribbean Economy and Tourism

Before any further discussion, it is imperative to first understand the distinct characteristics of the region's economy; namely, its reliance on international tourism. While the GDP per capita differs considerably between countries[2], the CARICOM nations are generally characterised as small economies widely open to trade, especially in the services sector (IMF (2013a)). The CARICOM economies can thus be grouped into those few who depend on commodity exports, namely Suriname, Guyana and Trinidad and Tobago, and the rest who rely on services, principally international tourism and business services (Schmid, 2018).

On average, travel and tourism represent 24% of GDP for a given tourism-dependent island, and for some, such as the Bahamas, Barbados and St. Lucia, it accounts for nearly 50% (Ruprah et al., 2014). This makes the Caribbean Community (CARICOM) one of the world's

[1] With the exception of the few commodity-based economies in the region.

[2] The GDP per capita can differ significantly from country to country

most dependent economy on tourism revenues (Romero, 2013).

However, the Caribbean tourism sector has been experiencing a significant downturn in the past decades. According to the IMF, the share of the Caribbean in the global tourism market and the region's US dollar incomes have both been steadily declining (See: Alleyne et al., 2017 and Laframboise et al., 2014). In 2001 tourists visiting the Caribbean spent 75% more than visitors to the Pacific islands; by 2010 this advantage was almost non-existent.

Scholars have identified both demand-side and supply-side reasons for the slowdown. On the demand-side, more players are entering the global tourism market, diversifying the inflow of existing customer base. This also requires greater competitiveness from the Caribbean tourism industry (Alleyne et al., 2017). For instance, the rapid growth in the Pacific islands, the region's main competitor, has partly originated from its connectivity to multiple travel routes and diversified customer base, attracting customers from countries like China, Australia, New Zealand, North America and Japan (SPTO, 2017). In contrast, the Caribbean depends mainly on North American and European tourists (Laframboise et al., 2014), whose economies have been severely affected by 2008 economic crisis.

On the supply side, structural problems regarding poor business environment and incompetent private sector are thought to halter further growth and innovation in the region (See Section 1.2. for further discussion).

1.2. The Role of SMEs and Business Environment

The Caribbean private sector consists mainly of small and medium-sized enterprises (SMEs), which represent between 70% and 85% of firms. This contributes between 60% and 70% of GDP and account for approximately half of the total employment (CDB, 2016). These firms are mostly locally owned and relatively mature, with an average age of 19.7 years[3]. They are also characterised as having low total factor productivity, lacking strong links to the international economy and highly concentrated in the retail and tourism sectors (Ruprah and Sierra, 2016; Khadan, 2017).

While some of these firms are formally incorporated, a large part of them remain informal enterprises. A report published by the IDB in 2017 estimates the informal sector to represent 35% to 44% of regional GDP (Amos, 2017). Such lack of formalisation of the market can be interpreted as the consequence of size-specific structural limitations, such as diseconomies of scale and high fixed costs.

However, market size is not the sole reason behind informality and performance of firms, since the Caribbean economy suffers from a particularly unfavourable business setting. According to the Global Competitiveness Reports by the World Economic Forum (WEF), Caribbean islands scored poorly on institutional support of the market, with all CARICOM countries placed in the bottom 50% for tax rates, corruption, access to finance and government bureaucracy (WEF, 2018). World Bank's Doing Business Index also ranked all but Jamaica in the bottom half.

Adding to the problem is massive brain drain. Almost three quarters of the tertiary educated labour force in the Caribbean is emigrating, with little remittance to compensate for public education investments and loss of productivity (Ruprah et al., 2014; Ticon Holdings, 2011).

While some efforts have been made to improve the climate, the resulting outcome has been very limited in scope. This, in contrast to the significant investments made by other developing economies, has resulted in stagnating business environment rankings for the Caribbean over the years (World Bank, 2018).

1.3. Tourism, Digitisation and Growth

Given the adverse institutional environment and macroeconomic trends, there is a consensus in the economic literature that tourism can once again serve as a powerful source of economic growth, if managed well (Cannonier and Burke, 2017 and Gunter et al., 2017). Multiple studies show a strong positive relationship between tourism and economic growth in the Caribbean, and the fact that global demand for tourism is rising poses an important market opportunity (Alleyne et al., 2017 and Zappino, 2005).

However, in order to fully exploit this opportunity the Caribbean must first strengthen its competitiveness against newer, more innovative players entering the global market. Essentially, this means that both public and private sectors of the tourism industry must strive for further innovation. This also means that major barriers hindering private sector growth should be removed.

In this report, we will argue that digitisation of the Caribbean tourism industry through private sector-led innovations on both micro (firm) and macro

[3]Average age of SMEs in the rest of small economies (ROSE) is 15 years.

(national/governmental) levels is an effective and feasible measure that can create real impact on the region's economy. Based on this, this report is structured in the following manner.

Section 2 explores various existing literature around the role of Information Communication Technologies (ICT) on economic development and private sector innovation, from which we derive the theoretical motivation of this paper. Section 3 contains a quantitative summary analysis of PROTEqIN, a firm-level survey data of all 13 CARICOM economies conducted in 2014 by the IDB. Our main concern is to identify the biggest perceived barriers by SMEs in the region, and the reasons behind them. It is important to note that our analysis is limited to formal SMEs. We proceed to econometric analysis of the impact of the identified barriers on the Caribbean economy. Namely, we model the two major barriers from the survey - *cost of finance and access to finance* - as a price friction using the Structural Gravity General Equilibrium Model.

Section 4 discusses case studies of real-life business cases of digital innovations that can be adopted and/or modified in the Caribbean to tackle the two barriers. More specifically, we explore solutions of digital currency/wallet, digital international payments, and digitised SME loans. We argue that private sector innovations can have similar effect, at least partially, as public sector regulatory changes, on the removal of economic barriers for SMEs. We also argue that supporting private sector innovations is more feasible and cost effective in the short run than massive policy changes.

Section 5 provides concrete recommendations and limitations for both Caribbean public and private sector on successful digitisation of the tourism industry.

2. DEVELOPMENT AND INFORMATION AND COMMUNICATIONS TECHNOLOGY

The information revolution has a positive correlation with economic development (Oyelaran-Oyeyinka and Lal, 2006). Indeed, digital revolution has radically changed not only the technology itself but also the patterns of knowledge within industrial clusters, thus defining a new global market structure (See: Wang et al., 2014).

According to Murphy and Carmody (2015), digital revolution can allow countries to circumvent existing institutional impediments to growth, by allowing firms to boost their technological capabilities, improving their knowledge accumulation, thereby fostering overall productivity.

In addition, Wilson (2004) argues that ICT revolution provides the opportunity to enhance new trajectories of technological spillovers in that it reduces the barriers and price frictions of adopting and importing new technologies.As companies face lower learning costs, firms in regions previously draught with barriers now have better resources to survive and thrive the process of creative destruction (See: Wang et al., 2014).

Not only so, the emergence of these digital solutions allows SMEs to capture finance and payments digitally. Such technology has the power to integrate the developing regions into the greater international market and consumers, which may have been out of reach previously. These innovations can then be applied to existing sectors such as tourism to create greater competitiveness. (Oyelaran-Oyeyinka and Lal, 2006). Cellphones and the Internet have also become a mechanism for correction of information asymmetries. and resulting price distortions that have presented as major development impediments in the past. By providing real-time information on the international market price as well as actual input values of each product, digital technologies have allowed the removal of middle agents in many economic processes, which has led to a better price adjustment within markets (See: Mansell, 1999). Thus, there has been an increment in the market welfare because information eliminates the price disturbances in the market transactions (See: Murphy and Carmody, 2015).

These transformations have inspired a new perspective on development in that countries may no longer need to industrialise to develop; but skip this step all together into high-tech service economies (Karmarkar et al., 2015). The implications of this is enormous, as it would mean that those countries with structural and institutional impediments to industrialisation could leapfrog into sophisticated service economies. This is particularly relevant for countries like the Caribbean, where population, size and resources are structurally disadvantaged from establishing large industrial projects and manufacturing which has historically been the stepping-stone to development.

Chesbrough and Rosenbloom (2002) establish that in evaluating information technologies, it is important to analyse the role of the business model, as often it is the successful business model that can unlock the true latent value of a particular technology. This means that the process of digitisation would require a favourable environment for doing business, including reduction of costs of business. Since many innovations come in the manner of Schumpeter's creative destruction, in which numerous entrepreneurs enter the market freely while driving out old processes, it is often deemed crucial to

provide a conducive business environment for innovative small enterprises (Kerr et al., 2014).

One of the most important types of technologies for driving business growth, especially for SMEs, is financial technology (Fintech). Successful fintech applications are thought to create a more diverse and stable financial landscape to improve activities and access to finance (Lee and Shin, 2018). Moreover, innovations in Fintech have provided the space for business to navigate more stringent regulatory environments in developing regions. This can propel the private sector forward in a way that may have been impossible previously. These benefits of digitisation also have positive effect on poverty alleviation. Digital technologies will grant market entries opportunities to the poor both as firm owners and as consumers (Murphy and Carmody, 2015). Moreover, traditional power relations can be reconfigured through the ease of access to information.

However, ICTs can also be used for regressive means (Murphy and Carmody, 2015), in the sense that it can become exploitative and solely empower large corporations. Because these entities have the capital and the economy of scale to acquire technologies, this may drive out innovation and access to information for other actors. Furthermore, simply adopting technologies have limited ability to inspire deep structural transformations for long-term development.

As such, while ICTs provide exciting opportunities for unprecedented form of economic development, it can also be a double-edged sword. Therefore, while creating a conducive environment for business innovation, it is highly encouraged for the government to be strategic in its vision. Proper policies and programs need to be initiated in developing countries in order to make SMEs more competitive (Wilson, 2004).

3. EMPIRICAL FRAMEWORK

3.1. Firm-level Survey Analysis

We conduct a firm survey analysis using pre-existing responses of 1,680 self-identified formal SMEs in the CARICOM services sector, in order to first identify key challenges perceived by Caribbean firms.

3.1.1. Data

The data comes from the results of the 2014 PROductivity, TEchnology and INnovation survey (PROTEqIN), carried out by the Inter-American Development Bank (IDB) in collaboration with Compete Caribbean and Étude Économique Conseil (EEC Canada). The survey was conducted in all 13 CARICOM countries[4] for 1,966 large, medium, and small firms of all sectors (agriculture, manufacturing, and services). The questionnaire includes an extensive examination of profile data of each firm, such as firm size and age, sector, performance metrics and financing status, as well as perception data such as opinion on management style, innovation and challenges to business. The data thus allow us to segregate firm profiles while comparing the perceived growth constraints faced by firms of interest. Only formally incorporated firms were included in the data (See: `https://bit.ly/2YBoF1m`).

Since this report is mainly interested in SMEs, we isolate data for small and medium size firms, from which we again isolate those working in the services sector only, giving us a total of 1,680 datapoints. We decided to include the data from Suriname, Guyana and Trinidad and Tobago despite the fact that they are commodity-exporting, to enable a more accurate representation of the larger region. We assume that all service sector SMEs are either directly or indirectly linked to the tourism industry, as the majority of the region's services trade is tourism-related (See: Ruprah and Sierra, 2016; Khadan, 2017; Schmid et. al, 2018).

3.1.2. Results: Access to finance and Cost of Finance

The data show that, for SMEs in the services sector in the CARICOM, the top three perceived limitations to firm productivity and performance were: the cost of finance (29%), access to finance (28%) and inadequately skilled labour workforce (28%). Moreover, contrary to popular belief, Caribbean SMEs in fact do recognise innovation as important for business activity. These firms identified technological and innovation support as the most urgent area in need of help to surpass their obstacles, followed by general management, business development and strategies support.

The fact that two of the top three limitations for SMEs are finance-related goes in line with the generally strict and limited financial infrastructure in the region.

Access to finance was a particularly prominent problem. Here, we define access to finance as accessibility (both ease and availability) of business financing (both external public/private capital or new streams of self-financing). The fact that 40.43% of SMEs applied for a formal line of credit in 2013 but only 11% had access to formal credit, suggests that rejection rate is high for smaller firms. With regards to existing source of finance (aside from the 11% who had private

[4]This includes: Barbados, Belize, Jamaica, Guyana, Suriname, Antigua and Barbuda, Dominica, Grenada, St. Kitts and Nevis, Saint Lucia, St. Vincent and the Grenadines, the Bahamas and Trinidad and Tobago.

credit), 64% responded that they relied on internal funds or retained earnings, 10% said they borrowed from government agencies and 15% of them purchased on credits from suppliers. Zero cases were reported on financing from angel investors, venture capitals, private equities or other alternative institutions, demonstrating limited access to finance from both bank and non-bank institutions

Cost of finance was also a major problem. Here, we define cost of finance as the cost incurred (financial and economic costs) at any given financial transaction (including accessing or repaying a loan, processing client payments, etc.). Perception data of those who did not apply for a formal loan in 2013 demonstrate a high perceived cost of a loan. Major identified reasons for not applying were: extremely high interest rates (13%), unattainable collateral requirements (9%), complex application procedures for loans or line of credit (9%), and fear of rejection (10%). Interestingly, 36% reported that they did not apply because of "lack of need," which goes in line with the fact that Caribbean SMEs have lower innovation and factor productivity; lack of perceived need for reinvestment leads to lack of innovation. However, this behaviour could well be a conditioned one, deriving from a prolonged period of bad business climate and high cost of finance.

Overall, PROTEqIN portrays a difficult financial environment for Caribbean SMEs to operate and grow. New technologies and innovative ways for removing these finance related barriers should be explored, for a more productive SME sector and overall economic growth.

3.2. Structural Gravity Model for Tourism

Based on the finance related barriers identified in the SME survey analysis, we then proceed to measuring the economic impact of removing these barriers on the Caribbean tourism industry. We calculate this by using the Gravity Equation as the theoretical framework, in which we consider tourism as an exportable good/service.

3.2.1. Insights: Gravity Equation

As mentioned previously, tourism is a service that has similarities with export goods. Thus, gravity models have been used in order to find its determinants.

The gravity model could be considered as the *workhorse* model in international trade (Yotov et al., 2016). It has been used not only to measure the impact of the traditional determinants of trade flows (such as distance, GDP, geography, tariffs, subsides, non-tariff measures, foreign direct investment, among others), but also different types of determinants and hypotheses.

Matias (2004) makes an estimation of a gravity model to understand the tourism trade in Portugal. The scholar acknowledges that tourism economics should be modelled by a gravity framework as, given the specific characteristics on tourism goods, it is possible to explain tourism flows as an export good. Indeed, Matias finds to the Portugal case that the GDP has an important empirical relevance, but that the role of distance is no less relevant in both theoretical and empirical terms.

Along the same line, following Hafiz and Fauzi (2010), who applied a similar analysis in the Malaysian context, state that the distance plays an important role to explain the tourism flows based on a negative correlation: the larger the distance the lower the tourism. Moreover, the authors use standard gravity model and observe that tourism demand is highly correlated with the Gross National Income of the tourist's origin country.

To Lordi et al. (2015), the concept of distance should consider a measure beyond its geographic meaning. In fact, the authors using a basic gravity model try to explain the tourism flows in the Caribbean and include the Linder's conjecture that establishes that the intensity in tourism depends on the similarities in the preferences of the countries. The results indicate that traditional gravity variables are significant in explaining demand for the region. Gaetano and Morelli (2015) have shown similar results in the case of Italy.

Moreover, Morley et al. (2014) propose a theoretical background to the gravity model for bilateral tourism flows derived from the individual utility theory. The authors derive a gravity equation to explain bilateral tourism movements. They find that "*the degree of interaction between two geographic areas varies directly with the degrees of concentration of persons in the two areas and inversely with the distance separating them*" (see Morley et al. (2014), page 2).

Other type of literature have tried to analyse if, beside of the traditional gravity variables, there are other variables that could explain and improve the tourism, such as climate similarity and transport and infrastructure (See: Malaj and Kapiki,2016).

Other literature has found finance-related factors as equally important. Martinez and Marquez (2010) find that financial and technological innovation improve the level of competitiveness and when the countries are closer, in terms of technological development, the negative effect of geography is reduced.Brei and von Peter (2017) find that the distance puzzle disappears in banking and financial services when countries are more globalised and their national regulations allow free-capital movements.

3.2.2. Theoretical Model

In order to measure the impact of removing the technological barriers, we developed a theoretical model to understand the relations of these barriers within the CARICOM economy.

As you can see in Appendix 1, this Structural Gravity Model was developed using the assumptions made by Armington (1969). Under this framework, we are going to assume that the tourists have a set of preferences modeled by a CES-utility function. This is because this utility function is quasilinear which implies that it is weakly separable and it is possible to differientate the effects of each destination on the tourist's preferences.

Additionally, with this function we assume that the tourist has a constant elasticity of substitution, which defines that the final consumption of each variety (destinations) will depend only on relative prices and not on other variables such as: income, scale or market structure. This is very important because it allows us to analyze the decision of tourism only throughout the price structure of providing the service of tourism.

Based on this we derived five key equations of structural model of tourism as seen in Table 1 (See Appendix 1 for detailed calculations).

	Definition
The Structural Gravity Equation:	$d_{ij}^{M} = \frac{E_j Y_i}{Y}\left(\frac{t_{ij}}{P_j \prod_i}\right)^{\frac{1}{\rho-1}}$
Inward Multilateral Resistance:	$\prod_i^{\frac{1}{\rho-1}} = \sum_j \left(\frac{t_{ij}}{P_j}\right) \cdot \frac{E_j}{Y}$
Outward Multilateral Resistance:	$P_j^{\frac{1}{\rho-1}} = \sum_i \left(\frac{t_{ij}}{\prod_i}\right) \cdot \frac{Y_i}{Y}$
Expenditure / Income / GDP:	$E_j = Y_i = p_i Q_i$
Market Clearance Conditions:	$Y_j = \sum_i d_{ij}^{M}$

TABLE 1: Structural Gravity Equations

Notice that in our model, the demand for tourism not only depends positively on the size of the economy of the partners and negatively on the price frictions (national and international), but also the term t_{ij}, which represents the technological barriers that we identified with the survey. Those barriers increase the cost of providing the tourism service.

Additionally, we have adjusted the model in order to match the equations to the gravity framework. In fact, given the microeconomic foundations of the model, if we had developed the model using the supply-side, we would have obtained the same equations (See Eaton and Kortum (2002)).

However, the key step in our model is the price friction because it is not only affecting the demand for tourism, but also given that this model is structural, the friction is present in each resistance term and the income/expenditure function of each country.

This is very important because it allows us to create counterfactuals in order to understand what will happen with the tourism flows if this price friction could be removed, as we can see in the following section. Thus, we are interested in finding the determinants of tourism in the Caribbean, but additionally, we are looking for to understand how the cost structure of the tourism firms and challenges in providing service have affected their performance and how 4G industrial solutions could improve their productivity.

3.2.3. Estimation

The analysis proposed in this paper attempts to identify the factors that determine the tourism flows in the Caribbean countries with a panel of 182 countries of the world throughout the period 2013-2017. The data was extracted from the World Tourism Organization, capturing only the Inbound Tourism and the arrivals by country.

On the other hand, regarding the methodological approach, the works of Rose (2004) and Anderson and Yotov (2010) were taken as a basis. It is important to highlight that a Pseudo Poisson Model of Maximum Likelihood (PPML) was applied as an estimation strategy.

The PPML estimator has several advantages, among which it is consistent in the presence of fixed effects, which can be entered as variables. This is an unusual property of estimators of maximum non-linear likelihood, many of which have poorly understood properties in the presence of fixed effects. This point is particularly important for gravitational modelling because most of the theoretical models around this subject require the inclusion of fixed effects at the individual and time level.

Secondly, the PPML estimator naturally includes observations for which the observed market value is zero. It is possible that the tourism flow contains countries with zero tourists for a year. Such observations are discarded from the OLS model because the logarithm of zero is not defined. However, they are relatively common in the trade matrix, since for a specific country and period the trade flow can be zero. Thus, eliminating observations at zero in the OLS estimate leads to a sample selection bias. Therefore, the ability of PPML is to include observations equal to zero in a natural way and without any specific addition to the basic model is very desirable.

Third, the interpretation of the PPML model coefficients is simple and follows exactly the same pattern as under OLS. Although the dependent variable for the PPML regression is specified as in levels rather than in logarithms, the coefficients of any

independent variable transformed into logarithms can still be interpreted as an elasticity.

$$\begin{aligned} Tour_{ijt} = \quad & exp[\eta_0 + \eta_1 GDP_{jt} + \eta_2 GDP_{jt} \\ & + \eta_3 Dist_{ij} + \eta_4 Lang_{ij} + \eta_5 Pop_{jt} + \eta_6 Pop_{it} \\ & + \eta_7 Colon_j + \eta_8 Contig_{ij} + \eta_9 Tech_{ijt} \\ & + \sum \phi_{jt} T_{jt}] \times \varepsilon_{ijt} \end{aligned} \tag{1}$$

The equation (1) shows the econometric gravity model. However, given the nature of the structural gravity equation and assuming that this structure remains constant at each period of time t, it is possible to log-linearize it and expand it with an additive error term ε_{ijt} (see equation (2)).

$$\begin{aligned} Tour_{ijt} = \quad & \beta_0 + \beta_1 ln\left(GDP_{jt}\right) + \beta_2\left(GDP_{jt}\right) + \beta_3\left(Dist_{ij}\right) \\ & + \beta_4\left(Lang_{ij}\right) + \beta_5\left(Pop_{jt}\right) \\ & + \beta_6\left(Pop_{it}\right) + \beta_7\left(Colon_j\right) + \beta_8\left(Contig_{ij}\right) \\ & + \beta_9\left(Tech_{ijt}\right) + \sum \phi_{jt} T_{jt} \times \varepsilon_{ijt} \end{aligned} \tag{2}$$

Where the variable $Tour_{ijt}$ represents the flow of tourist between each of the 15 Caricom countries and the country j in the period t measured in number of people from the country j that visit any of the Caricom countries. GDP_{jt} is the Gross Domestic Product of the partner country measured in constant dollars of 2010. GDP_{it} is the Gross Domestic Product of each Caricom country measured in constant dollars of 2010. $Dist_{ij}$ is the distance between each Caricom country i and the partner country j measured in kilometers. $Lang_{ij}$ is a categorical variable that takes the value of 1 if the official language of the partner country is English and 0 otherwise. Pop_{it} is the total population of each Caricom country i, measured in millions. Pop_{jt} is the total population of each partner country j, measured in millions. $Contig_j$ is a categorical variable that takes the value of 1 if the Caricom country i and the partner country j are close (share border), and 0 otherwise. $Colon_j$ is a categorical variable that takes the value of 1 if there was a colonial relationship between the Caricom country i and the partner country j, and 0 otherwise.

$$Tech_{ij} = \begin{cases} 1 & if \quad Countries_{Caricom} \neq Countries_j \\ 0 & if \quad Otherwise \end{cases} \tag{3}$$

Following Anderson and Yotov (2010), given the price friction in the provision of the tourism service, it is possible to model this distortion as a barrier (see equation (3)). The aim is to assess the general equilibrium impact on tourism and GDP of the removal of technological barriers that are increasing the cost. Removing these barriers will show the potential effects of the implementation of 4G Industrial revolution in the tourism sector in the Caribbean countries. This is a quantification of the an effective multilateral trade facilitation given an increase in competitiveness.

T_{jt} is a set of Fixed Effects at partner country level and time period. In fact, following to Baier and Bergstrand (2007), these pair Fixed Effects control the endogeneity of the relationship between countries. That means that these set of variables are used in order to control the unobserved effects proper to each country in a specific period of time. Likewise, these variables isolate the effect that the particular economic environment of each partner could have on CARICOM's bilateral tourism flows.

Given that this is an structural model, the estimation is run in a two-stage procedure. In the first-stage, we estimate the pair fixed effects using the standard gravity variables. In the second-stage, we recover the pair fixed effects estimated (gathering the unobservable information among countries) and we construct a matrix of multilateral trade resistances in order to perform counterfactual experiments.

3.2.4. Findings

Table 2 demonstrate the result of the structural gravity. In general, the traditional gravity variables are statistical significant to explain the tourism in the Caricom Countries[5].

In accordance with the gravitational theory, the bigger the size of the economy, the more demand for tourism. In fact, an increment in the GDP of the trade partners will rise the tourism in 25,4% (result very similar to that found by Lordi et al. (2015)).

The distant reduces the tourism flow to Caricom Countries in 73%. This is supported in the gravitational trade theory that explains the further away the country is, the more difficult it is to be able to make exchanges due to transportation costs.

If the population of the partners increases, the demand for tourism will rise in 21,3%. If the countries share English as the first language, the tourism increases in 61,3%, which explains why United States, Canada and United Kingdom represent on average the 82% of the total tourism in the Caricom Countries.

Likewise, if both countries share a colonial relation in the past, the tourism increase in 18,8% (same cultural preferences predicts a demand for destinations with similar values).

[5] As it was established before, given that this is a PPML-estimator, the coefficients should be transformed using an exponential function. Therefore, the transformation is: $\widetilde{Coef} = \left(exp\left(\widehat{coef}\right) - 1\right) * 100$.

VARIABLES	Tourism
Log of Product of Real GDPs Caricom Countries	0.226***
Log of Product of Real GDPs partners	0.280***
Log of Distance	-1.318***
1 for Common Language	0.478***
Log of Population Caricom Countries	0.261
Log of Population Partner Countries	0.193***
Dummy for pairs in Colonial Relationship	0.172***
Land Border Dummy	0.034***
Technology Barrier	-0.136***
Constant	-313.458
Observations	7,595
R-squared	0.715
Year FE	YES
Country FE	YES
Countrytime FE	YES
Countrypair FE	YES
r2_p	.
ll	-468416

*** p<0.01, ** p<0.05, * p<0.1

TABLE 2: Gravity Model

One result that is interesting is that the closer countries (share border) do not represent an important factor that increases the demand of tourism. Indeed, sharing the same border only increases the tourism in the CARICOM countries in 3,45%. This could be explained by the fact that, given we are analyzing the CARICOM countries as a group, this reduces the explanatory power of the neighbors.

Finally, we estimated the model in two steps in order to create a counterfactual scenario to analyze what would happen if the barriers were removed. Estimating the observable and non-observable relations between the CARICOM countries and the rest of the world and introducing them in the model it allows us to recreate a scenario in which, all else being equal, we can capture the effect of removing the price frictions. In our counterfactual scenario, removing the technological barrier increases the tourism in the CARICOM countries in 12,7%.

This means that the cost of finance and access to finance are constraining the possibilities to provide a better and efficient tourism service in the region. As we have stated before, these two barriers affect the productivity of the firms and since the majority of companies that provide the service are SMEs, the effect is magnified because this type of company is more risky for the financial market.

In fact, using an elasticity of substitution of $\widehat{\rho} = 6$[6], this barrier represents a cost equivalent of 2,2% of the GDP in the CARICOM countries.

4. BUSINESS CASES: COST OF FINANCE AND ACCESS TO FINANCE

Based on the identified impact of finance-related barrier removal on the Caribbean tourism industry, we now turn to case studies of real-life business innovations that can help tackling the two main barriers: cost of finance and access to finance.

4.1. Business Innovation as Macroeconomic Solution

Although concepts like price friction and industry growth may seem purely macroeconomic, the solutions to these challenges do not necessarily have to be so. This is especially true in the short run, when initiating and experimenting changes require certain level of agility. We thus argue that concrete and implementable business innovations, although *micro* in individual application, are feasible solutions that can have significant macroeconomic impact in the long run.

1. *Business innovation is agile.* Adopting and co-experimenting with digital innovations led by private entities provide a much more agile solution than implementing macro-scale policy changes; especially for financial policies. Financial regulations are generally very risk averse and have a rigid process of modification. This means going through a highly bureaucratic process, various reports, approvals, and risk evaluations, budgetary arrangements and negotiations with foreign banks. Considering that each Caribbean island has a different regulatory regime, any substantial change on a policy level could take a very long time.

   On the other hand, adopting and/or co-experimenting with established fintech instruments can provide a more immediate solution and can be implemented rapidly across the market. Policy changes corresponding to these innovations could happen at an incremental scale at a faster rate.

[6] See Yoto et al. (2016)

Digitisation distributed through the agile market also means that the technology will be adopted rapidly, creating a macroeconomic impact. The case of MPesa in Kenya illustrates this. 268,000 people subscribed to M-Pesa only 3 months after launch, and, in 3 years, this had jumped to 10.3 million (Onsongo, 2017). As can be seen, one "micro" solution of mobile money led to an overall reduction of poverty thanks to its agility (Suri and Jack, 2016).

2. *Business innovation is cost-effective.* Introducing and/or adapting an existing ICT instrument can be more cost-effective than a macro level policy changes, at least in the short run. For one, implementations of initial micro level solutions to reduce the risk of failure. A smaller scale allows fluid iterations of trial-and-error type experiments, which improve the product's adaptation and market fit incrementally. Furthermore, rolling out an existing solution on a small scale simply requires less resources and costly procedures. Designing and implementing a new regulation nationwide (or regionwide) is obviously more costly than executing smaller experiments, especially when the risk is high due to the *newness* of solutions.

   This cost-effective nature also applies for the SMEs themselves. In an environment where most firms are unable to make large investments for deep transformations, adopting a technological innovation can be extremely cost-effective, especially for financing options. Because navigating traditional financial services is difficult and often unattainable, access to alternative fintech innovations can provide new opportunities for SMEs to adopt more productive practices. Thus, at least for the initial stage of "testing out" new innovations, micro scale business solutions can be very effective.

3. *Business Innovation is more feasible.* Therefore, applying existing digital instruments can be a feasible solution for the Caribbean. With this, governments do not have to go through as much lengthy lobbying/negotiation/compromise process as it would be required for macro scale regulatory changes. Given the status quo rife with structural challenges, it is much more feasible to start with smaller, more implementable areas, than trying to tackle multiple problems at once. Given the complex and fragmented nature of the Caribbean financial system, bottom-up fintech innovations could represent not only a more feasible option but also a potentially transformational one, since the removal of intermediaries can eventually have a natural integrating effect for the Caribbean economic cluster.

4.2. Problem and Case Studies: Cost of Finance

One of the most prominent barriers to business identified is the cost of finance in the Caribbean. In this report we define cost of finance as the cost incurred (financial and economic costs) at any given financial transaction. This includes interest rates charged by banks and the costly transaction fees as ineffective or extra measures that a firm must take in order to make a financial transaction due to inadequate financial infrastructure, among others.

An underdeveloped banking sector with inadequate competition in the Caribbean is a big part of the problem, resulting in more expensive service provision. The average real interest rate in the CARICOM in 2017 was 7.7%, which is 2 percentage points higher than that in other Upper Middle Income Countries[7]. On top of this, opening a bank account involves a highly bureaucratic procedure, often requiring strict collateral requirements that most SMEs cannot meet (See: subsection 4.3.).

However, even those who meet the requirement still face enormous limitations, due to the high cost of finance. One problem is the lack of online payment structures by banks. In a market where foreign customers prefer to pre-book plans online, not having access to an online gateway can be a huge disadvantage (Beecher et al., 2018). Even the most widely-used non-bank gateways like Stripe and PayPal do not have presence in the Caribbean due to high risk and small market size, further limiting options(Haet, 2015). Offline payment options are equally limiting. The post-2008 crisis Basel III Regulatory Framework has resulted in an extreme level of risk aversion among banks, who consider SMEs as a high-risk and low-return clientele. As a result, SMEs are often offered limited amount of services with exorbitant charges and burdensome transactions requirements (Beecher et al., 2018). Typically, Caribbean merchant transaction fees range from 4% to 6%, while global average hovers around 1% and 2% (See Annex 4 for a comparative table of local and international costs).

This had led some Caribbean SMEs to purposefully incorporate into the US to access American financial

[7] Using the World Bank Analytical Income Classifications, we found that the CARICOM countries as classified as Upper Middle Income Countries. Then, we merged the information of real interest rate, provided by the IMF, and made the comparison.

instruments (Haet, 2015). However, such measures are not only unnecessarily expensive economically but also inaccessible for the majority of smaller firms in the Caribbean. On one hand, this creates an unnecessary capital outflow of tourism-generated revenue by successful firms; on the other hand, it perpetuates informality among smaller firms (Beck and Demirguc-Kunt, 2006). The result is a setting in which entrepreneurs are disincentivised from using the financial system and are mostly dependent on informal cash-based transaction; an environment largely incompatible for scale economic development (Love and Martinez, 2012; ILO, 2017).

Innovative digital payment technologies are surfacing as a potential solution for lowering the cost of finance(Resendiz, 2017). This lowers the cost of payment transaction via mobile and internet,which can unlock a significant amount of untapped revenue for firms. Start-ups like Mongo and Revolut revolutionised the banking system by using decentralised technologies thus circumventing third parties in the process and reducing cost. Cases like M-Pesa in Kenya has demonstrated a similar possibility in the developing world.

4.2.1. Case 1: Bitt Inc.

Founded in 2013, Bitt is a fintech company based in Barbados that utilises blockchain and distributed ledger technology for mobile money payments (Bitt.com, 2019). Bitt offers two key products for lowering the cost of finance for SMEs: mMoney and Wallet for consumer and merchants, and an on-going project of Central Bank Digital Currency (CBDC) for governments seeking financial innovation.

mMoney and Wallet: Bitt distributes its version of mobile money (mMoney) to both consumers and merchants. Similar to Kenya's M-Pesa, users can download a mMoney application on their smart devices, from which they can send, receive and store mMoney. User can also *cash-in* via designated merchant tellers, who will convert the deposited cash into mMoney. Users can then use the mMoney wallet for transactions with Bitt's steadily growing merchant network. The cost of service is entirely free for consumers, while merchants get charged a small fee per transaction (US$0.20): the lowest fee in the region at the time of this report. Bitt's mMoney solution can significantly lower the cost of payment systems for the SMEs. This allows the merchant to access greater revenue resources that they can later be used for reinvestment.

Central Bank Digital Currency (CBDC): Bitt is also offering a potentially systems-changing solutions for the Caribbean public sector:namely, the use and circulation of digital currencies issued by the central bank, or the CBDC. So far, Bitt has signed an MOU with Eastern Caribbean Central Bank (ECCB) to run a pilot on blockchain-backed CBDC in the ECCB member countries (M. Dukharan, personal communication, Feb 18, 2019). In such digital ecosystem, the Treasury of the state could potentially pay out their government salaries and social benefits using this digital currency, further facilitating the circulation of CBDC. More conversations and experiments with other governments of this sort are expected to follow.

Since November 2018, Bitt is also participating in a Regulatory Sandbox framework with the Central Bank of Barbados and the Financial Services Commission as the framework's first participant. Defined as a *live testing space* for innovative financial products, this Sandbox Framework will enable the Barbados regulators to access and understand the ambiguities surrounding rising financial technologies. Successful experimentation may lead to a regulatory reform.

Implications: Bitt's mobile/digital money product, when orchestrated in a right manner, couldbecome a solution that radically simplifies transactions and thus lowering the cost of finance in two ways. One is by getting rid of middlemen, therefore lowering transaction fees and time. Each transaction takes place on the personal smartphone of each customer, reducing the economic cost of accessing services by overcoming the cumbersome bureaucratic process. Another is by creating a largely cost- effective yet deeply personalised security measures (Lumb et at., 2016). A secure distributed ledger technology drastically lowers the monitoring costs of each transaction regardless of size, and lifts the limitation of *high risk low return* for SMEs. These advantages are especially prominent in a developing market context where inflexible financial regulatory framework prevents easy banking access. M-Pesa's success could potentially be replicated in the Caribbean context.

Not only so, if Bitt's service expands to the larger market in the Caribbean, this would directly affect the productivity of the SMEs, which consists of a large part of the economy, and therefore affect the growth of the general tourism sector. With mMoney and wallet, visitors who are coming in the Caribbean will have the opportunity to pay in a digitally, enabling small producers and enterprises to be further integrated. In this context, tourists would now be able to making digital payments to local SMEs, not just to established

corporations .

4.2.2. Case 2: Trekksoft

Founded in the Swiss Interlaken in 2010, Trekksoft offers a suite of online booking and payment solutions for firms offering tours and activities (Trekksoft, 2019). Trekksoft's SaaS (Software as Service) back office connects both offline and online sales and management of a tour operator, thereby aiming to augment sales and growth potential of a business. While Trekksoft's clients range from large to small, the company's main clientele is the mid-tier who does not have the luxury of corporate administration and in-house technology. The Caribbean is a small but growing market for Trekksoft's global presence, with 40-50 current clients.

Trekkpay (Payyo): The most interesting element of Trekksoft for the Caribbean lies in its *niche* combination of booking and payment technologies. Trekkpay (renamed Payyo as of April 2019), the company's online payment gateway, presents a much simpler way of processing international payments for Caribbean tour operators, as it can bypass a major part of Anti-Money Laundering (AML) monitoring process. Every payment transaction and purchaser information is linked automatically with date and time of the booked activity. Such ease of cross-reference and uniquely fixed nature of activity tours lower the chance of fraud, making the payment process simpler and faster for merchants (A. Rodrick, personal communication, Mar 13, 2019). However, this only holds true for fixed day-tour activities. Non-fixed products like physical products and vouchers cannot be incorporated through the same system due to a higher risk of fraud.

Trekksoft now offers some of the cheapest international payment rates at €3.3% + 0.06 per transaction, plus a monthly subscription for the back office system (ranging from US$50 to US$200). Trekksoft has also begun to integrate other payment gateways onto its platform, such as VISA, Mastercard, and PayPal (Trekksoft, 2019). This then has the potential to connect consumers from anywhere in the world to the merchant's bank account, even when the account is located in a financially restrained country. Where global giants PayPal and Stripe dared not to enter, Trekksoft aims to expand its niche market.

Implications: A widespread adoption of an effective digital booking and payment system, even if limited to day-tour activities, can be vastly advantageous for Caribbean tour operators and may lead to sector long-term growth. A simpler and faster payment means greater working capital for SMEs, who often struggle from lags of payment but fail to find financing alternatives. By bootstrapping with higher revenue streams, SMEs can now make re-investments for long-term growth with less limitations. Greater back office efficiency powered by computerised system can also boost productivity.

However, applying this technology in the region is not without its limitations. First, Trekksoft's global fees may be out of reach for many local SMEs, limiting its impact to formal enterprises with larger revenues. Another is the financial infrastructure. Anthony Rodrick, VP of Sales at Trekksoft, report of several clients who do not have access to a credit card or have very low daily/monthly transfer limit, which stifle their purchasing of the software. Lastly, the overall lack of tech savviness of the SME owners in the region is also hindering the demand for adoption.

4.3. Problem and Case Studies: Access to Finance

Access to finance was identified as another challenge from the survey. Here, we define access to finance as accessibility (both ease and availability) of business financing (both external public/private capital or new streams of self-financing).

If cost of finance is crucial to the sustainability of business, access to finance is crucial in the start-up and expansion of it. SMEs typically require two phases of financing: the start-up phase and the growth stage. The gap between the amount needed for growth and what the entrepreneur has is called the financing gap; and the ability to meet this gap often determines the rate, size, and ambition of growth. This micro-level constraint, applied to a developing country setting where SMEs comprise of the majority of the economy, can create a structural limitation to growth (Banerjee and Duflo, 2011), which has been validated by multiple cross-country researches (Beck and Demirguc-Kunt, 2006).

Empirically, cross-country research on firms has shown that SMEs experience twice as much growth setback as their larger counterparts when facing financing constraints (Beck et al., 2005). On the other hand, a slight improvement in financial infrastructure and access can bring about a disproportionately large positive effect on SMEs (Beck et al., 2009), compared to the larger firms. Other studies have identified non-financial and economic spillover effects of better access to finance on SMEs, such as decisions to start a businesses or profit reinvestments (Djankov et al., 2005; Johnson et al., 2002 and Cull and Xu, 2005).

Such positive effects can be potentially greater in

the Caribbean, where most SMEs rely on small sums of informal credits or self-financing. However, the post 2008 crisis financial regime has virtually closed most affordable SME financing options. The Basel III regulations now require detailed verification process per firm, making lower cost SME loans now too costly for banks to provide (Koreen, 2012). This leads to banks closing doors on SMEs on the premise of high risk. The result is that many entrepreneurs are forced to operate outside of the formal financial system and have very limited access to finance.

This problem arises from the large level of information asymmetry between the banks and the SMEs in the CARICOM region. Partly this is because of the bank's risk averse behaviour, but another part is because of SME's lack of formal credit history. Because access to formal finance is inadequate, most businesses turn to cash economy for operations, which then leads to an ambiguous credit history for banks to evaluate, leading to even more limited access. Such vicious cycle creates a double asymmetry, in which the lenders cannot gauge the borrower's creditworthiness, and the borrower doesn't know if it is *worth it* to pursue formal financing (Diamond, 1984; Moro et al., 2014).

Heavy dependence on collateral is another problem. Most traditional banks rely on the collateral requirement to sort high-risk borrowers from the low-risk ones. However, not all SMEs can meet this requirement, especially in an underdeveloped financial market as that of the Caribbean (Holden and Howell, 2009). All these structural factors can be barriers to economic growth.

4.3.1. Case 3: OmniBnk

OmniBnk is a non-bank financial institution that provides innovative invoice-backed financing to SMEs powered by behavioural machine learning. Founded in 2016 in Colombia, the venture has raised 3 rounds of capital and is quickly branching out into Chile, Mexico and other Latin American economies.

OmniBnk's unique value lies in its low-cost and efficient risk screening system for SMEs via using alternative datapoints: mainly through the government electronic invoicing system. Many Latin American governments use electronic paper trail to track VAT payments, which then documents every formal transactions of firms in the form of invoice. These datapoints have allowed OmniBnk to develop a proprietary machine learning algorithm that calculates models of *good* and *risky* firm behaviors, from studying past patterns of good debt and bad debt. Regular transaction history with regular clients are seen as low risk behaviour (or "boring, monotonous relationships," as OmniBnk CEO Diego Caicedo calls it), and vice versa, especially for suppliers of big corporations.

The risk evaluation process takes place 100% digitally and in a matter of minutes. Once a potential borrower submits her scanned national ID and legal incorporation document on the OmniBnk website, OmniBnk automatically analyses the firm's past invoice data, calculates the risk, and within 5 minutes is able to offer personalized financial products. Thanks to the fully digitised process, the average loan deposit time is only 24 hours, and the average loan size is around USD$40,000 in Colombia and USD$70,000 in Chile: a sizeable amount that can be used as growth investment for SMEs. Present default rate is below 1% (Finextra, 2018).

OmniBnk also offers invoice-based financing, which is more flexible than the strict collateral-based policy of the traditional banks. Invoices, especially those confirmed by the debtor, are considered very low risk, and thus loans pertaining to the amount of the invoice can be issued out before payment date, in order to allow greater liquidity of the firm.

Implications: OmniBnk presents an innovative, relatively low cost alternative credit scoring for SMEs. This infrastructure is particularly favourable for the formal SMEs in the tourism sector, as being a supplier of a corporation (major hotel chains, etc.) allows SMEs to be considered lower risk (in the sense that they will be engaging in regular, large volume transactions). Although the implications on the informal sector is less clear, by allowing the formal SMEs to expand and grow beyond their current liquidity limits can potentially have great impact in the growth of the tourism sector. However, for OmniBnk system to be fully in play, digital invoice infrastructure or digital paper trail must be established first.

5. RECOMMENDATIONS, LIMITATIONS AND CONCLUSIONS

5.1. Recommendations

As explored in the previous sections, adopting and co-experimenting with ICT and digital innovations can be a feasible and effective short-term solution to circumvent present growth barriers in the Caribbean SME tourism sector. Existing business solutions as presented above are already actively engaging with current clients in the Caribbean as well as developing economies with similar conditions. Further incorporation of these already validated innovations could thus be an effective and feasible solution for the early stage of digitisation.

However, engaging with the businesses alone cannot solve macro level challenges, unless met with adequate government support. The Caribbean public sector should consider micro adaptation of these solutions as the first step of a long-term development of a sustainable innovation ecosystem. Therefore, it must simultaneously start working on both short-term and long-term public initiatives for promoting innovation, including application of existing technologies, encouragement of new inventions and civil participation.

Based on this, we recommend the following reforms to be considered:

1. *Creating an enabling regulatory framework:* A substantial, if not the most prominent, part of the growth barriers identified by the SMEs come from the inflexible regulatory environment. While financial regulations are a necessary measure to prevent market failure, the current structure is extremely limiting for furthering innovation and competitiveness; at a time when raising competitiveness has become crucial to promoting economic growth.

   An enabling environment requires a balance between innovation promotion while maintaining the integrity of the financial system. Regulators can draw upon the successful experience of both developed and other developing nations to define the best models for the Caribbean context. For instance, the Public-Private Partnership scheme (PPP) has proven to be a preferred regulatory toolkit to promote both business innovations and better provision of public services, especially through improved operational efficiency, in areas such as: communications services and infrastructure, data privacy protection, cybersecurity, intellectual property rights, etc. (Guermazi and Satola, 2005).

   Thus, respective governments of the Caribbean can benchmark theses successes to create and replicate their own versions. Recent advances by central banks of Guyana, Jamaica, Bahamas, Barbados, and Trinidad and Tobago, in development of mobile money payment and circulation shows a promising start in this direction (Beecher et al., 2018).

2. *Establishing a regional sandbox:* Regulators often find it difficult to design an appropriate regulatory framework for new ICT innovations. With fintech s evolving faster than existing regulations, regulators have limited understanding of the risks and functioning mechanisms of these innovations. A proven and effective mechanism to deal with these situations is a regulatory sandbox, also part of the PPP as mentioned above. A regulatory sandbox allows regulators and companies to co-experiment with new innovations at a smaller scale, in a controlled yet enabling space for innovations. Regulators can thus monitor the risk associated and design appropriate measures, while businesses can improve product-market fit on the go.

   Barbados is already leading the way by engaging in a regulatory sandbox for digital currency (See: section 4.2.1.). However, given the small size of the island, more countries in the CARICOM must participate in order to achieve a collective regional effect. By learning from initial sandbox experiments, CARICOM regulators can further optimise results and enable economies of scale in the future.

3. *Building trust in digital payments:* Envisioning a strategic roll-out of financial digitisation also requires an active effort of the government to promote the trustworthiness of digital payments. This is particularly important in the Caribbean where there is a general dearth of public digital savviness

   According to the World Bank (Klapper and Singer, 2014), digitising the government's own payments and receipts, including social transfers and the utility bills, can create an important foundation upon which the private sector can build a bigger trust in digital payments for the public. The ECCB's pilot agreement with digital currency can potentially have great positive effects. If and once other regional central banks follow suit, the Caribbean economy could benefit from an exponential effect coming from an efficient regional integration.

4. *Improving the financial literacy education:* There is a significant gap in the Caribbean between what the general public knows and what they need to know to make informed financial decisions. Financial literacy is a salient problem in many developing economies, but it becomes an even more complex one for digital matters. To a public that lacks both digital savviness and financial literacy, especially the business owners of SMEs, working with financial technologies could pose significant risks and challenges. Therefor, the public sector must urgently provide awareness programs and digital financial literacy education. (OECD, 2018). Business versions of Financial literacy

education could be a complementary measure for SME owners.Successful graduation of these courses could be used as an additional credit history information to further facilitate the businesses' access to finance.

5.2. Limitations

While this report highly recommends business-led digitisation of the tourism sector, this is not without limitations.

Firstly, private interests can be different from public interests. While entrepreneurial endeavours in a market setting create an ideal force for innovation, it is the public sector's role to strategically promote these efforts and create an enabling environment. Under market institutions deemed too risky or inflexible, firms will not take private risks to generate innovation for social benefits. It is thus the government's role absorb the initial risk, such as through initial experimentations and support, so that the entrepreneur can continue innovating with full force. Similarly, private returns sought by private firms may clash with the social returns. This is especially important with regards to data or private security. Relying completely on private firms could create an opportunity for data abuse and exploitation of private information of the consumers. Thus, the Caribbean public sector must strike a balance between its role as a regulator and as a creator of innovation-friendly market environment.

Secondly, the impact of micro business solutions will highly depend on the scale to which the businesses expand. This report has highlighted the agile nature of business applications as an effective short-term solution, while assuming their potential capacity to scale rapidly. However, without an enabling environment and a long-term public vision, it can be difficult for the business innovations to scale. Without scale, the overall impact would be marginal in a segmented small economy the Caribbean. Thus, the CARICOM governments should think about the macro strategy of not only their respective countries but also of the regional networks.

Thirdly, the scale of adoption may be hindered by the informality and lack of digital savviness by SMEs. Because most digital innovations require formalisation as a starting requirement, the extent of chronic informality in the Caribbean private sector may pose a significant challenge in the adoption of new practices. At the same time, the general lack of digital awareness and distrust of new technologies will also affect the adoption rate. Business management practices are often sticky, especially when the firm's human capital is not very familiarised with newer practices.

Lastly, distributional effects of technological innovations must also be considered. Adoption of new technologies can create winners and losers, as it can create productivity surplus to some but take away job opportunities for others. Specifically, effects on the labour market must be thoroughly revised in this regard. In a setting in which high skilled labour is rare and the rest of labour force is thought to be costly and unproductive, efficient tools of digitisation could be used to replace conventional jobs. Although this report explores mostly financial innovations rather than operational innovations where labour-related concerns could be slightly lower, this trade-off is still an important issue to consider and must be met with adequate measures.

5.3. Conclusions

This research into the Caribbean has identified the main barriers constraining growth of the the tourism sector, The recent slowdown of the Caribbean economy derives mostly from the lack of tourism sector competitiveness as well as the growing competition from alternative destinations. Given that a large share of the region's economy consists of SMEs, this report then analysed an extensive SME survey data of all 13 CARICOM economies to identify two major growth barriers: cost of finance and access to finance. Using these two as price friction in a gravity equation in which tourism is considered a services trade, we find that removing the two identified barriers can result in a 12.7% increase in annual tourist arrivals. Moreover, we find that these barriers represents a cost equivalent to the 2.2% of the regional GDP.

This report argues that in order to remove this growth barrier it is important to adopt and promote business solutions and ICT innovations. Three cases of existing solutions have been explored, each one tackling main growth barrier. Micro-level experimentations with such businesses, especially in financial technologies such as digital payments and loans, can minimise risk and maximise learnings in the beginning stage of innovation. However, such efforts cannot be borne by the private sector alone, especially under an imperfect market institution. Therefore, this report urges the Caribbean public sector to engage in creating an enabling environment for firms, especially SMEs, as well as to participate in awareness and educational initiatives.

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7. APPENDIX

7.1. Deriving the Structural Gravity Model for Tourism

A.1.: Theoretical Model

The first applications of Newton's Law of Gravity to international trade date back to Ravestein (1885) and Tinbergen (1962), who used the gravity equation to study immigration and trade flows, respectively. However, it was Anderson (1979) who proposed the theoretical framework from which this model emerges, assuming a basket of goods differentiated by their place of origin and a function of elasticity utility of constant substitution (CES).

The model starts by considering a set of N countries, where each economy produces a variety of goods (differentiated by their place of origin) that are traded with the rest of the world. In this case, each economy provides tourism as a service. The offer of each good is fixed Q_j at a price p_j.

Likewise, the value of domestic production in a representative economy is defined as $Y_i = p_i Q_i$, where Y_i is the nominal income of country i. The aggregate demand of country j is denoted by E_j, which can be expressed in terms of the nominal income of the economy $E_j = \varphi Y_j$, where $\varphi > 1$ shows that the country has a trade deficit, whereas $1 > \varphi > 0$ indicates a surplus.

Based on the assumptions made by Armington (1969), these homothetic preferences are modeled by the equation (4):

$$Y_j = \left\{ \sum_i \beta_i^{-\rho} \cdot d_{ij}^{\rho} \right\}^{\frac{1}{\rho}} \tag{4}$$

We assume that the utility of the tourist j depends on the tourism services provides by the destination i; an elasticity of substitution $\rho = \frac{\sigma-1}{\sigma}$[8]. Additionally, β_i is the CES parameter that represents is the weight which the tourist values the destination with.

Following Arrow et al. (1961) and Armington (1969), we establish two stages: In the first stage, the tourist decides her consumption for tourism, determining the aggregate output and expenditure in each country. In the second stage, the equilibrium determines bilateral allocations of tourism among countries.

$$\begin{array}{ll} max & Y_j = \left\{ \sum_i \beta_i^{-\rho} \cdot d_{ij}^{\rho} \right\}^{\frac{1}{\rho}} \\ s.t. & \sum_i p_{ij} t_{ij} d_{ij} = E_j = Y_i \end{array} \tag{5}$$

[8]Notice that we assume that $\rho \in (0,1)$ because the varities of destinations $d_{1j}, d_{2j}, ..., d_{ij}, ..., d_{nj}$ are not perfect either substitute nor complementary goods.

Given that, the equation (5) shows the maximization problem that tourist faces. You can see that in order to model the contingencies that the tourism firms face in the Caribbean, we add the term t_{ij} in the consumer's income constraint.

This term represents the barriers that we identified with the firm-level survey. In order to include them in the model, we assume that these barriers act as a price friction in the tourism market in the Caribbean. Given that $t_{ij} > 1$, the price for the service is higher and the demand is reduced because of that. Solving this problem, the marshallian demand for tourism is given by the equation (6) (See the Apenndix 2).

$$d_{ij}^{M} = (tijp_{ij})^{\frac{1}{\rho-1}} \beta_i^{\frac{\rho}{\rho-1}} \cdot \left[\frac{E_j}{\sum_i (tijp_{ij})^{\frac{\rho}{\rho-1}} \beta_i^{\frac{\rho}{\rho-1}}} \right] \tag{6}$$

Using the assumptions of Anderson and van Wincoop (2003), we can define $P_j = \sum_i (tijp_{ij})^{\frac{\rho}{\rho-1}}$, which is the price structure of the country that provides the tourism service. Additionally, imposing the Market Clearence condition that states that the income of the country i is the final consumption of tourism offered by the country j, $Y_i = \sum_j d_{ij}^{M}$, we obtain the value of the country's production i, Y_i, as an expresion of the total expenditure on tourism of all the countries of the world, including itself.

$$\frac{Y_i}{Y} = \sum_i \left(\frac{\beta_i p_i t_{ij}}{P_j} \right)^{\frac{1}{\rho-1}} \cdot \frac{E_j}{Y} \tag{7}$$

Notice that the equation (7) has been re-expressed in terms of the relative contributions of nominal income, having defined a world's GDP as $Y = \sum_j Y_j$, because, following Anderson and van Wincoop (2004), bilateral trade is determined by *relative* trade costs and given that the size of the income in relative terms attracts more goods and services.

In addition, we are going to define the Multilateral Resistance Terms (MRT) that capture all the trade cost. Anderson and van Wincoop (2004) find two terms: Inward and Outward Multilateral Resistances. Both MTR cover not only the national cost structure but also the cost structure of the other countries.

The Inward Multilateral Resistance is defined as $\prod_i^{\frac{1}{\rho-1}} = \sum_j \left(\frac{t_{ij}}{P_j} \right) \cdot \frac{E_j}{Y}$. It shows the trade costs that the Country i faces in order to provide its tororism services. According to Anderson and Yotov (2010), the Inward Multilateral Resistance could be interpreted as the sellers' incidence of trade costs from origin i.

$$\frac{Y_i}{Y} = \sum_i \left(\beta_i p_i \prod_i \right)^{\frac{1}{\rho-1}} \tag{8}$$

The equation (8) includes the Inward Multilateral Resistance Term (IWMT). Notice that the IWMT depends negatively on the factory gate price of the country j, P_j. If the costs of providing tourism of the other countries is lower, the price for this service in the country i would be higher and viceversa. Therefore, the factor P_j is re-defined by Anderson and Yotov (2010) in order to endogenize this relationship between bilateral trade cost.

Thus, the Outward Multilateral Resistance Term (OWMT) is defined as $P_j^{\frac{1}{\rho-1}} = \sum_j \left(\frac{t_{ij}}{\prod_i} \right) \cdot \frac{Y_i}{Y}$. P_j is interpreted as buyers' prevalence.

$$d_{ij}^M = \frac{E_j Y_i}{Y} \left(\frac{t_{ij}}{P_j \prod_i} \right)^{\frac{1}{\rho-1}} \tag{9}$$

The equation (9) is the structural demand for tourism that reorganizes the equation (8) in order to include both multilateral resistance terms (See Appendix 3).

Given that, it is possible to capture the gravity analyses. As it is established by Yotov et al. (2016), the trade between two countries, as same as the gravitational force among objects, is directly proportional to the product of their sizes (masses) and inversely proportional to the trade frictions (the square of distance) between them.

Therefore, there is more bilateral trade the larger the countries and less bilateral trade the more the distance between them.

	Definition
The Structural Gravity Equation:	$d_{ij}^M = \frac{E_j Y_i}{Y} \left(\frac{t_{ij}}{P_j \prod_i} \right)^{\frac{1}{\rho-1}}$
Inward Multilateral Resistance:	$\prod_i^{\frac{1}{\rho-1}} = \sum_j \left(\frac{t_{ij}}{P_j} \right) \cdot \frac{E_j}{Y}$
Outward Multilateral Resistance:	$P_j^{\frac{1}{\rho-1}} = \sum_i \left(\frac{t_{ij}}{\prod_i} \right) \cdot \frac{Y_i}{Y}$
Expenditure / Income / GDP:	$E_j = Y_i = p_i Q_i$
Market Clearance Conditions:	$Y_j = \sum_i d_{ij}^M$

TABLE 3: Structural Gravity Equations

As we have presented before, the Table 3 summarizes the five equations of our Structural Model for Tourism.

A.2.: Marshallian Demand for Tourism

The maximization problem is given by the equation (10):

$$\begin{array}{ll} max & Y_j = \left\{ \sum_i \beta_i^{-\rho} \cdot d_{ij}^{\rho} \right\}^{\frac{1}{\rho}} \\ s.t. & \sum_i p_{ij} t_{ij} d_{ij} = E_j = Y_i \end{array} \tag{10}$$

Given that, the lagrange equation would be stated by the equation (11):

$$£ : \left\{ \sum_i \beta_i^{-\rho} \cdot d_{ij}^{\rho} \right\}^{\frac{1}{\rho}} - \lambda \left[\sum_i p_{ij} t_{ij} d_{ij} - E_j \right] \tag{11}$$

The First Order Conditions are given by:

$$\frac{\partial £}{\partial \lambda} = \sum_i p_{ij} t_{ij} d_{ij} - E_j = 0 \tag{12}$$

$$\frac{\partial £}{\partial d_{ij}} = Y_i^{1-\rho} \cdot \beta_i^{-\rho} d_{ij}^{\rho-1} - \lambda t_{ij} p_{ij} = 0 \tag{13}$$

Solving equation (13) for d_{ij}, we get:

$$d_{ij} = Y_i \cdot \left(\lambda t_{ij} p_{ij} \beta_i^{\rho}] \right)^{\frac{1}{\rho-1}} \tag{14}$$

Inserting (14) into (12) and solving for $\lambda^{\frac{1}{\rho-1}}$, we have:

$$\lambda^{\frac{1}{\rho-1}} = \frac{E_i}{Y_i \sum_i \left(t_{ij} p_{ij} \right)^{\frac{\rho}{\rho-1}} \beta_i^{\frac{\rho}{\rho-1}}} \tag{15}$$

Inserting (15) into (14) and solving for d_{ij}, we have the Marshallian Demand for tourism:

$$d_{ij}^M = \left(tijp_{ij} \right)^{\frac{1}{\rho-1}} \beta_i^{\frac{\rho}{\rho-1}} \cdot \left[\frac{E_j}{\sum_i \left(tijp_{ij} \right)^{\frac{\rho}{\rho-1}} \beta_i^{\frac{\rho}{\rho-1}}} \right] \tag{16}$$

■

A.3.: Structural Marshallian Demand for Tourism

The Marshallian Demand for Tourism is given by (16). However, the factory price gate of the country j is defined by:

$$P_j = \left[\sum_i (tijp_{ij}\beta_i)^{\frac{\rho}{\rho-1}}\right]^{\frac{1}{\rho-1}} \tag{17}$$

Introducing this price, equation (17), into the Marshall Demand, equation (16), we have:

$$d_{ij}^M = \left(\frac{tijp_{ij}\beta_i}{P_j}\right)^{\frac{1}{\rho-1}} \cdot E_j \tag{18}$$

Imposing a Market Clearence condition, we are assuming that at delivered prices the sum of all marshallian demands is equal to the nominal income. This means, that:

$$Y_i = \sum_j d_{ij}^M = \sum_j \left(\frac{tijp_{ij}\beta_i}{P_j}\right)^{\frac{1}{\rho-1}} \cdot E_j \tag{19}$$

According to Anderson (2011), due to fixed costs, bigger countries have more active firms, all else equal. Because of that, the number of active firms contributes to determining the national income. In order to control the size in the gravity structure, it is necessary to weight the size of each economy by its relative share in the global economy. To do that, we divide the equation (19) by the world GDP, as follows:

$$\frac{Y_i}{Y} = \sum_j \left(\frac{tijp_{ij}\beta_i}{P_j}\right)^{\frac{1}{\rho-1}} \cdot \frac{E_j}{Y} \tag{20}$$

Using the definition of Inward Multilateral Resistance made by Anderson and van Wincoop (2004), which is given by the equation (21):

$$\prod_i^{\frac{1}{\rho-1}} = \sum_j \left(\frac{t_{ij}}{P_j}\right) \cdot \frac{E_j}{Y} \tag{21}$$

In addition, if we solve the equation (21) for P_j, we can define the Outward Multilateral Resistance as:

$$P_j^{\frac{1}{\rho-1}} = \sum_i \left(\frac{t_{ij}}{\prod_i}\right) \cdot \frac{Y_i}{Y} \tag{22}$$

Now, using the definition of Inward Multilateral Resistance, we are able to re-write (20) as:

$$\frac{Y_i}{Y} = \sum_j \left(p_{ij}\beta_i \prod_i\right)^{\frac{1}{\rho-1}} \tag{23}$$

Solving equation (23) for $(\beta_i p_{ij})^{\frac{1}{\rho-1}}$, we have:

$$(\beta_i p_{ij})^{\frac{1}{\rho-1}} = \frac{\frac{Y_i}{Y}}{\prod_i^{\frac{1}{\rho-1}}} \tag{24}$$

Introducing (24) into (22) and (18), and combine with the definition of (21), we find the Structural Marshallian Demand for Tourism that is presented in the equation (9):

$$d_{ij}^M = \frac{E_j Y_i}{Y}\left(\frac{t_{ij}}{P_j \prod_i}\right)^{\frac{1}{\rho-1}} \tag{25}$$

■.

7.2. Additional Information

A.4.: Comparative Cost of Digital Payments

Type of Service	Payment Services	Fees				
		Set Up	Deposit	Withdrawal	Transaction	Forex
International Digital Payment Services	*Pay Pal*		2.9% + $0.30	Up to $5	2.9% + $0.30	2%+5%+ Fixed Fee
	Stripe Atlas	$500			2.9% + $0.30	
Local Merchant Accounts	*Credit Cards*				4 - 6%	
Local Digital Payment Services	*My Cash*	$0	$2	$2	2.25%	$5
	GK MPay	$0	$0.75	$0.75	$0.05 - $1.11	$4.50 - $9.50
	NCB Quisk	$0	$0	$0	1% + GCT	N/A
	mMoney	$0	$0	$0	$0	N\A

TABLE 4: Comparative cost of digital payments to local costs (USD)

Source: Beecher et al. (2018)

7.3. Terms of Reference

A.5.: Terms of Reference

IDB

COMPETE CARIBBEAN

LSE THE LONDON SCHOOL OF ECONOMICS AND POLITICAL SCIENCE

TERMS OF REFERENCE

Organisation and Department

Compete Caribbean is a multi-donor facility funded by the Inter-American Development Bank (IDB), the United Kingdom Department for International Development (DFID), the Government of Canada and the Caribbean Development Bank (CDB). www.competecaribbean.org

The LSE Consultancy Group, based in London, is a group of MSc student consultants from the London School of Economics' Department of International Development. The LSE consultants come from a variety of professional backgrounds and expertise, including the public/private sector work in IT and Development in the LAC, Asia, Europe, and Africa. http://www.lse.ac.uk/international-development

Project Working Title

Leapfrogging the Caribbean private sector: How can digitization and innovation of Tourism Industry Cluster lead to a sustained economic growth in the CARICOM countries?

Background

Caribbean countries have experienced a significant slowdown in GDP growth per capita over the past three decades. Adoption of technological innovation among MSMEs may help to reverse this trend. SMEs represent 69% of firms (Ruprah and Sierra 2016), and a report published by the IDB in 2017 estimates the informal sector to represent 35% to 44% of GDP (Amos, 2017).

Part of this lag could be attributed to the fact that most Caribbean economies missed the opportunity to join the ICT and Internet revolution in a timely manner. Productivity starts at the firm level and it is affected by many factors including innovation and adoption of technology. Most LAC countries demonstrate both lack of basic ICT infrastructure (broadband, computer density, etc.) as well as lack of innovation and digitization of their economies (Navarro, 2018).

Tourism is an important part of the GDP for the Caribbean, representing 14.9% of the region's total GDP in 2016 while forecasted to rise at a rate of 3.6% p.a. from 2017-2027. A large section of this industry is supported by the MSMEs and the informal sector (WTTC, 2017). Yet, despite the industry's increasing

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economic importance, business innovation and digitization has significantly stalled in the sector compared to those of other tourism economies.

Given the economic slowdown and the looming potential of the Tourism sector, it has become imperative to explore options of innovation and digitization to leapfrog the Caribbean tourism sector into the digital era. This can be achieved by leveraging existing structures, improving institutional support, while taking advantage of the existing local players characteristics.

Consultancy Objective

In line with the Compete Caribbean's initiative to increase access to Technology Extension Services (TES) among firms in the region, the LSE consultants will produce a comprehensive report on exponential opportunities for digital transformation in the tourism sector. The findings of this research can be used to create a demand for new technologies and increase the access to them for the private sector, and to foster discussions on creating new ICT-oriented regulations or deregulations for the public sector. This report will also inform stakeholders on potential directions for the industry with the aim of contributing to sustainable and inclusive growth.

Compete Caribbean publishes a monthly newsletter to 11,000 subscribers across 13 countries. The research can be shared through the newsletters, conferences, and Facebook live events to inspire and educate the private and public sectors.

Preliminary Outline of the Project Report

1. Economic Overview and Literature Review
   a. Overview of economy of CARICOM & importance of tourism
   b. Lit Review: digitization theories and strategies for developing economies

2. Quantitative Analysis: Challenges & Econometric Model
   a. Analysis of firm-level survey data: major challenges for SMEs
   b. Econometric Model based on Gravity equation: impact of removing costs of barriers (identified by survey) for SMEs on tourism & economic growth

3. Business Solutions Analysis: Business innovations that tackle major challenges for SMEs & have macro-implications for the tourism industry.

4. Conclusion & Policy Recommendation

Methodology

The proposed research will be conducted with a combination of the following methodologies:

1. Literature Review
2. Quantitative Analysis of firm-level survey data (Compete Caribbean Survey)
3. Case studies
4. Interviews (Business owners)

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Deliverable and Project Milestones

The proposed research will consist of the following deliverables and milestones.

Mid-December Finalized Terms of Reference approved by Compete Caribbean
Early February Touch-base call on preliminary outline and findings
Early April Touch-base call and CC feedback on preliminary version
Early May Final presentation of deliverable

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