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CLUSTERS IN THE CARIBBEAN:

Understanding Their Characteristics, Defining Policies for their Development

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Compete Caribbean is a private sector development program that provides technical assistance grants and investment funding to support productive development policies, business climate reforms, clustering initiatives and Small and Medium Size Enterprise (SME) development activities in the Caribbean region. The program, jointly funded by the Inter-American Development Bank (IDB), the United Kingdom Department for International Development (DFID) and the Foreign Affairs, Trade and Development Canada (DFATD), supports projects in 15 Caribbean countries. Projects in the OECS countries are implemented in partnership with the Caribbean Development Bank.

Executive Report

During the last two decades, industrial clusters have showed successful performance and ability to drive the growth of developed countries' regions in Europe (see the cases of Italy, Germany and the UK), the US and Japan. These success stories have attracted interest from scholars in development studies and policy makers at international organizations, such as UNIDO, UNCTAD, IADB and the WB.

Caribbean economies face challenges such as climate change, low productivity, high emigration rates, high public debt, poor regional linkages, narrow scope to build economies of scale due to the small size of their domestic markets and high susceptibility to exogenous shocks due to their openness. An approach that focuses on clusters and on their characteristics such as collective efficiency, information and knowledge sharing, division of labor, sharing of specialized inputs and collective access to market suits the Caribbean countries. Clusters represent an opportunity for Caribbean economies and their enterprises, in particular their SMEs, to access larger and more sophisticated markets, to improve knowledge and technologies, to train specialized human capital and to lobby governments for infrastructure and specific policy supports that would otherwise be unavailable to individual companies.

The aim of this report is to map Caribbean cluster cases and identify their specific characteristics, based on the existing literature and on the available empirical evidence. An empirical exercise is undertaken through a desk review of 32 cases of clusters distributed in a variety of industries across the Caribbean, such as natural resources based industries, comprising agriculture, agro-processing, forestry, aquaculture and energy; manufacturing; and services, embracing tourism, creative industries and business services.

The empirical evidence collected is carefully analyzed along six cluster dimensions considered to influence their competitiveness, on the basis of prior academic work. Each dimension is assessed on quali-quantitative grounds – i.e. based on a very detailed analysis of available documents, we have measured each dimension quantitatively (typically using Likert scales or other categorical classifications).

The six dimensions are the following.

- 1) **Cluster Structure** including a) *sectorial specialization*; b) *geographical boundaries* and c) *organization structure* by distinguishing among survival, Marshallian and hub-and-spoke clusters;
- 2) **Collective Efficiency** as the sum of *external economies* (specified as specialized labor market, availability of inputs, access to information, market access) and *joint action*, namely backward and forward linkages, horizontal bilateral linkages (i.e. cooperation between firms working at the same stage of the value chain) and multilateral linkages (i.e. cooperation that involves firms, public, public-private organizations at the local level, local associations, chambers of commerce, NGOs, or any other local actor, including universities and research centers);
- 3) **Innovation Capacity** taking into account a) the knowledge and technological base of the cluster firms, b) the intra-cluster knowledge system, c) the extra-cluster knowledge system, and d) the innovation system;
- 4) **Openness** aimed at classifying clusters on the basis of how open they are. Three main channels are considered: a) export orientation, b) presence of multinational corporations (MNCs) in the cluster (both foreign and local), c) cluster firm participation in global value chains (GVCs);
- 5) **Stages of the Cluster Life Cycle** classified as a) *emergence*, when there is a small number of actors and low or low/medium joint action and semi-open knowledge networks, b) *growth*, when the number of actors is increasing and there is medium or high joint action and open knowledge networks, c) *sustainment*, when there is a large number of actors and medium or high joint action and open or semi-open knowledge networks, d) *decline*, when there is a large number of actors and low or low/medium joint action and closed knowledge networks;
- 6) **The Role of Policies** on the basis of whether cluster formation or development has been promoted by policy interventions. We thus suggest the following classifications: a) spontaneous clusters with no sign of policies for establishment or development, b) clusters with policy from inception, when clusters have been founded through policy interventions, c) clusters with policy for development, with the cluster development process being supported by policies.

Based on these key cluster dimensions, through cluster analysis – a multivariate statistical technique that serves to identify different groups of similar actors - we have found three groups of clusters, two of them (named *Rising* and *Innovative Clusters*) are fairly similar, and they are both markedly different from the other group (named *Sluggish*

Clusters).

Rising Clusters include mainly emerging and growing clusters at the early stages of their life cycle. In this group, clusters specialize in relatively new industries for the Caribbean region, such as the animation and the multimedia sectors, or exploit new market segments, as can be found in eco-tourism in Grenada, Guyana and Suriname. Moreover, they tend to be very open to external actors, partially because hub firms populate them. In fact, this group includes all of the hub-and-spoke clusters identified in this study. This organization structure facilitates external connections for cluster-based firms, as it allows access to knowledge and markets. Two examples from Guyana are the coconut water cluster, which is organized around a processing firm from Trinidad and Tobago and the non-traditional agricultural products cluster led by an Israeli MNC. In spite of being open and growing, these clusters do not display outstanding records both in terms of collective efficiency and of innovation capacity, which we classified as medium in our scale. Hence these clusters deserve policy attention aimed at further sustaining cluster development.

Innovative Clusters share some similarities with the group of *Rising Clusters* (i.e. high openness), but the former are more innovative than the latter. Marshallian clusters displaying high collective efficiency and innovation capacity compose this group. Their sectors of specialization include some of the traditional industries in the region, such as the oil sector and the business, financial and maritime services, as well as the very dynamic aquaculture clusters in Guyana and Belize. This group appears to include the most successful clusters in the region, most of which have been assisted by cluster policies.

Sluggish Clusters differ significantly from the other two groups. They are far less active and dynamic: they have on average a low to medium level of collective efficiency, very weak innovation capacity and a low degree of openness. They are organized as Marshallian clusters – i.e. they are populated mainly by local small enterprises, which interact with each other at either sub-national, urban or national levels. In some cases, their firms only target the local market and this represents a clear constraint for further growth – as can be seen in the cases of the pottery and retail clusters in Trinidad and Tobago and that of the gold jewellery cluster in Guyana. This group includes several spontaneous clusters, which have not received any policy treatment, while many of them would benefit from the presence of cluster policies.

To conclude, *Rising* and *Innovative Clusters* include the most dynamic, innovative, open and collaborative types of clusters in the Caribbean region – with some differences existing in terms of their innovation capacity, cluster life cycle and organization structure. In contrast *Sluggish Clusters* represent the most passive and backward clusters in the region.

Drawing from this classification, we provide diversified policy recommendations for the different groups of clusters. In *Rising Clusters* policies should focus on: a) fostering innovation, b) helping the transition of emerging clusters to a growing phase; c) supporting the consolidation of leading actors. *Innovative clusters* are the most successful in the region. In these clusters policies should very selectively promote promising projects. Because these clusters are already rather dynamic, such dynamism should be enhanced and sustained but this should be done by targeting projects that are likely to further push these clusters to the frontier of knowledge or to allow them serving highly demanding markets, or market niches. Finally, in *Sluggish Clusters* priorities should be: a) strengthening local joint action; b) enhancing openness for the access to valuable resources like knowledge and technologies; c) building up innovative capabilities.

A systematic monitoring and evaluation of whether measures targeted at clusters deliver the expected results in terms of enhanced local inter-firm coordination, networking with extra-cluster actors and economic, social and environmental performance is a must and should become part of standard practice to foster necessary and continuous processes of experimentation and policy learning.

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1. Introduction

During the last two decades, industrial clusters have showed successful performance and ability to drive the growth of developed countries' regions in Europe (see the cases of Italy, Germany and the UK), the US and Japan. These success stories have attracted interest from scholars in development studies (see, for example, Schmitz, 1995; Rabelotti, 1999) and policy makers at international organizations, such as UNIDO, UNCTAD, IADB and the WB. An important question has been how clustering is experienced in other geographic regions.

Caribbean economies¹ face challenges such as climate change, low productivity, high emigration rates, high public debt, poor regional linkages, narrow scope to build economies of scale due to the small size of their domestic markets and high susceptibility to exogenous shocks due to their openness. An approach that focuses on clusters and on their characteristics such as collective efficiency, information and knowledge sharing, division of labor, sharing of specialized inputs and collective access to market suits the Caribbean countries. Clusters represent an opportunity for Caribbean economies and their enterprises, in particular their SMEs, to access larger and more sophisticated markets, to improve knowledge and technologies, to train specialized human capital and to lobby governments for infrastructure and specific policy supports that would otherwise be unavailable to individual companies.

The aim of this report is to map Caribbean cluster cases and identify their specific characteristics, based on the existing literature and on the available empirical evidence. The empirical exercise is undertaken on 32 cluster cases distributed in a variety of industries across the Caribbean.

The report is organized as follows. Section 2 provides a definition of the cluster concept and reviews the relevant academic literature. In Section 3 some key background information about the Caribbean region is presented with the aim of identifying those features that can influence Caribbean clusters and their innovation capacity. Section 4 presents the criteria for classifying the cluster cases. The classification of the empirical cases from the Caribbean region is the focus of Section 5. Section 6 concludes the report, drawing some policy implications.

¹ In this report we focus on the beneficiaries of the Compete Caribbean program: Antigua and Barbuda, The Bahamas, Barbados, Belize, Dominica Republic, Dominica, Grenada, Guyana, Haiti, Jamaica, St. Lucia, St. Kitts and Nevis, St. Vincent and the Grenadines, Suriname and Trinidad and Tobago.

2. The main features of clusters

In this section we selectively review the literature on clusters with a focus on the main characteristics that are adopted as classification criteria in the mapping exercise of the Caribbean clusters presented in Section 5.

2.1. The baseline definition of cluster: geographical concentration and sectorial specialization

The baseline definition of cluster contemplates the co-existence of two main characteristics: the concentration of firms in a spatially bounded area and their specialization in the same or related industries. Clusters with both these characteristics are present in many developing countries, with a wide range of well-documented cases in the context of Latin America (see Pietrobelli and Rabellotti, 2007). One of the key drivers for the generation of clusters is their proximity to a natural resource or a market. This explains, for instance, why touristic activities are co-located near natural attractions and producers of consumer goods set up shops near large urban areas to reduce transport costs.

The spatial extension of clusters can vary a great deal and we distinguish between the following different types of clusters. *Local clusters* are defined as clusters whose firms operate in a geographically bounded area that is *not* urban; therefore it is either a rural area or an industrial area located outside the main cities. This includes clusters with regional boundaries (intended in the EU sense of territorial subdivisions of countries), or even smaller areas (e.g. an agglomeration of a few small cities or villages). Examples of sub-national clusters are the Italian industrial districts, often centered on middle-size cities such as Prato in Tuscany or Biella in Piedmont (Becattini, 1990) and Silicon Valley in the United States (Saxenian, 1996). Clusters may also coincide with large cities and in this case we refer to *urban clusters*. Creative, cultural and service industries are often clustered in such a way, such as the financial sector in London, the Bollywood film cluster in Mumbai or the software production cluster in Bangalore (Lorenzen and Mudambi, 2013). While local and urban clusters have tended to be the most conventional form of clusters, scholars have in some cases interpreted their geographical boundaries in a loose way (see Porter, 1998) and introduced a type of cluster whose boundaries are set

by the national borders (i.e. *national clusters*) of a country. According to Porter, clusters are geographical concentrations of interconnected companies and institutions in a particular field with a geographic scope ranging from a single city, a state, a country or even a network of neighboring countries. Among the examples, Porter provides several cases, which cover the territory of a whole state, such as California or a country, such as Sweden. Finally, then, clusters may transcend national borders and extend to other countries (i.e. *inter-country clusters*), as shown in the case of the Danish-Swedish Öresund biotech cluster (Andersson et al, 2004). Inter-country clusters are particularly relevant in the Caribbean area, given the very small size of many of its island countries.

The sectoral specialization of clusters is another important dimension, and it usually implies that cluster firms operate in sectors that are related to each other. As pointed out in Giuliani et al (2005), the organization of production, the relevance of firms' economies of scale, the technological complexity and the modes and sources of innovation differ across sectors, and these differences may impact on their growth trajectories. As remarked earlier, the clustering of economic activities is a widespread phenomenon across the globe and many industries tend to concentrate spatially. For instance, many Italian industrial districts² have specialized in low tech, labor intensive manufacturing industries - i.e. the so called 'Made in Italy' sectors such as clothing and textiles, footwear and leather, furniture and tiles. In many developing countries there are also many clusters specialized in these industries. But clusters are also present in medium- and high-tech industries, such as automobile, consumer electronics, machinery and mechanical industries, ICT, biotech, and green technologies. Firms operating in natural-resource industries also cluster geographically as they set up their activities to directly exploit certain localized resources (see the cases of copper, oil, fruit and fish, which are widespread in developing countries). Moreover, natural and cultural attractions represent a source of agglomeration for clusters specialized in the tourism sector. Finally, economic activities are also geographically clustered in the tertiary industry. There are clusters specialized in creative industries, including advertising, film and video, music, performing arts, publishing, and fashion as well as in the financial sector. As seen above, these industries show an urban nature, as they tend to cluster in the largest urban agglomerations, where they may play an important role for the local economic base

²In Italy, clusters are usually called industrial districts referring to the Marshallian concept used for describing textile-producing areas of Great Britain during the Industrial Revolution (Marshall, 1920). This concept of Marshallian cluster is described in more detail in Section 2.2.

(Lazzaretti et al, 2008; Scott, 2000).

2.2. Cluster organization structure

The internal organization of clusters may vary widely, even within the same industry. Although real world clusters are very complex, cluster analysts and scholars have proposed classifying clusters according to a number of organizational dimensions, among which there are the size of firms, the nature and characteristics of their relationships and the degree to which they depend on external organizations. On these grounds, and drawing on Markusen (1996) and Altenburg and Meyer-Stamer (1999), we classify clusters as follows.

Marshallian-style Clusters refers directly to the concept of Italian industrial districts proposed by Becattini (1990), characterized by the spatial concentration of small and locally-owned firms and a high division of labor, with firms specialized in different phases of the local productive chain and strongly interacting with each other. This kind of cluster often includes the presence of a strong social dimension. They are therefore considered to be places where entrepreneurs are well embedded in a local community of people, characterized by a relatively homogenous system of values and norms, a strong local identity and by well-developed supporting institutions facilitating the development of trustful interactions. Obviously, the Marshallian clusters are not restricted to Italy, and there are examples of this kind of clusters in which the presence of the various identifying features can vary a great deal in other developed and developing countries (Rabellotti, 1995). In the case of the LAC (Latin America and Caribbean) region, Pietrobelli and Rabellotti (2007) have shown that the division of labor within the cluster, the degree of trust and the intensity of collaboration can indeed be very diverse. On the basis of these empirical results, we adopt a loose definition of Marshallian clusters, including a critical mass of specialized small and medium enterprises and some backward and forward providers, and we expect to find a large diversity of situations in this category.

Hub-and-spoke Clusters refer to a typology of clusters in which one or more firms (sometimes MNCs) act as anchors or hubs to the local economy and orchestrate the local network of suppliers and related activities (Markusen, 1996). The large hub firms often have substantial links to suppliers, competitors and customers outside the district. This may represent an interesting dynamic feature of this model because external

connections act as sensors for innovation and creative activities taking place in other locations and enable the transfer of new ideas and technology to the cluster³.

A third typology of clusters, which is relevant in the context of less developed countries, are survival clusters where (mainly informal) micro and small-scale enterprises produce low quality goods for the local markets, mainly in activities where barriers to entry are low. Firms in these clusters display many characteristics of the informal sector, with poor productivity records and wages far below the national average. The degree of inter-firm specialization and cooperation is also rather limited, reflecting the lack of qualified and skilled employees in the local labor market, as well as a fragile social fabric (Altenburg and Meyer-Stamer, 1999). Many of these survival clusters have been documented in Latin America and the Caribbean and they often specialize in traditional industries such as clothing, footwear, furniture, auto-repair and food processing.

It is important to notice that real-world clusters may be a mix of one or more of the above-mentioned types and that clusters are dynamic systems, changing over time, both in absolute terms - consistent with the evolution of their member firms, workers and institutions - and in relative terms, that is, compared to other clusters. Hence, their classification may evolve through time.

2.3. Collective efficiency

The simple fact of being located in clusters (i.e. geographical agglomerations of firms operating in the same or in interconnected sectors) does not make firms more successful. The heightened economic performance of cluster firms is often due to the co-occurrence of other factors (e.g. inter-firm division of labor, presence of a wide network of suppliers and of business associations), which are common in advanced countries clusters and which are often considered to manifest themselves within clusters in developing countries. To account for these factors, Schmitz (1995) introduced the concept of *collective efficiency* (CE), defined as the competitive advantage derived from local incidental external economies and consciously pursued joint action.

³In Markusen (1996) there is also a cluster type denominated *Satellite Clusters* and consisting of a congregation of branches of externally based multi-plant firms, which are often MNCs. Their localization is often the result of national/local policies, and takes the form of Export Processing Zones (EPZ). This type of cluster is not considered in this study.

Marshall, in his *Principles of Economics* (1920), first introduced the concept of *external economies* (EEs). He defined EEs as positive or negative unpaid, out-of-the-market-rules side effects of the economic activity of one economic agent on other agents. In clusters the most common external economies are generated by the presence of the following conditions:

- a) Pooling of specialized skilled labor, which increases the likelihood to hire already trained workers;
- b) Creation of a local market for inputs, machinery and specialized services facilitating increased availability, competition on price, quality and service;
- c) Easy access to specialized knowledge and the rapid dissemination of information; and,
- d) Market attraction of customers due to the concentration of producers.

Schmitz (1995) considers that clustered firms benefit from EEs just by being there and for this reasons he considers them to be passive forces present in clusters. According to Schmitz (1999), incidental EEs are important in explaining the competitiveness of clusters, but he also suggests that consciously pursued *joint action* (JA) by local firms and/or other organizations are an important driver of clusters' competitiveness. JA is in turn facilitated by the presence of strong social ties and by high levels of trust existing among co-located firms and entrepreneurs (Nadvi, 1999). Schmitz (1999) identifies three forms of JA:

- a) Bilateral vertical JA, which refers to collaboration along the value chain (e.g. between client and supplier firms);
- b) Bilateral horizontal JA, which refers to collaboration between two or more cluster enterprises, specialized in the same industry, including joint marketing of products, joint purchase of inputs, order sharing, common use of specialized equipment, joint product development, and exchange of expertise and market information;
- c) Multilateral JA, which refers to collaboration between a wide variety of actors, particularly between firms and cluster-wide organizations such as business association and business development service centers. This type of JA includes cooperation among complementary cluster firms and supporting institutions and business association.

The combination of incidental EEs and JA determine the degree of cluster collective efficiency. The presence of both forces is crucial for competitiveness: passive EEs may not suffice without JA, and JA hardly ever develops in the absence of EEs.

2.4. *Innovation in Clusters*

Scholars have long recognized that innovative activities are spatially concentrated (Audretsch and Feldman, 2004). This is mostly ascribed to the fact that the innovation process involves the sharing of tacit knowledge, which requires face-to-face interactions and geographical proximity to occur. The conventional understanding of innovation in clusters considers it to be due to the presence of localized knowledge spillovers – a form of externality that is generated by the interaction of geographically concentrated and specialized firms, as well as by imitation and demonstration effects. In that context, clusters' innovative processes are seen as the result of a collective learning process, involving local entrepreneurs and employees, who contribute to and benefit from the presence of a pool of local knowledge in a fairly homogeneous way (Capello and Faggian, 2005).

Against this background, more recent studies show that knowledge in clusters may not circulate as smoothly as previously described and propose that firms' own knowledge bases (or innovation capabilities) influence both their capacity to generate local spillovers, as well as to benefit from these spillovers by absorbing local knowledge (Giuliani and Bell, 2005). Moreover, scholars have highlighted the importance of extra-cluster networking as a way to rejuvenate the cluster knowledge base and avoid processes of negative lock-in (Bell and Albu, 1999; Bathelt et al, 2004). In this respect, a growing number of studies focus on the role played in clusters by leading firms, which are typically large, technologically advanced firms, acting as a bridge between non-local knowledge and the majority of small firms (Bell and Albu, 1999; Giuliani and Bell, 2005). These firms have been defined as technological gatekeepers and are key actors in channeling extra-cluster knowledge into the local intra-cluster knowledge system (Giuliani, 2011; Morrison, 2008).

Furthermore, external connections to actors in the innovation system are also important. Thus knowledge linkages with different types of organizations - such as universities, vocational schools, technology agencies, R&D centers and the other economic and political institutions - can affect technology and knowledge diffusion in clusters (Lundvall

et al, 2009). The location of these organizations may vary from the local to national levels (i.e. may be part of the local, regional or national innovation system).

Based on the above considerations, the innovation capacity of clusters is related to four interrelated aspects: a) the knowledge base of the cluster firms; b) the intra-cluster knowledge system; c) the formation of linkages with extra-cluster sources of knowledge (i.e. the extra-cluster knowledge system); and d) the degree of development of the (local, regional, national) innovation system in which the cluster is embedded. Adapting from Giuliani (2005), the cluster innovation capacity can thus be defined as:

a) Low:

- i. Cluster firms have weak knowledge⁴ and technological bases far from the technological frontier, with low-skilled human resources and very limited in-house capacity of knowledge generation;
- ii. Very limited and weak knowledge linkages between firms characterize the cluster;
- iii. The cluster has no links with extra-cluster sources and there are no technological gatekeepers;
- iv. The innovation system is weak with a very underdeveloped knowledge infrastructure.

b) Medium:

- i. Some firms in the cluster have good knowledge and technological bases, possess the ability to adopt and adapt knowledge and technologies generated in other places (e.g. international knowledge) to their local needs, but their knowledge-generating potential is limited and generally oriented at improving products on an incremental and adaptive basis;
- ii. The cluster has a more connected intra-cluster knowledge system;
- iii. The cluster has some interconnections with extra-cluster sources of knowledge and there are a few local technological gatekeepers;
- iv. There are some knowledge institutions such as vocational schools, universities and technological centers supporting the innovation process within the cluster;

c) High:

⁴ The term knowledge is used in this document to refer to all types of knowledge that are not necessarily machine-embodied, like expertise in a given field, capacity to design, develop a service or a product.

- i. Most firms in the cluster have very good knowledge and technological bases and they possess skilled human resources;
- ii. The cluster has a dense intra-cluster knowledge system;
- iii. The cluster is well connected with extra-cluster sources of knowledge and many firms play the role of technological gatekeepers;
- iv. The innovation system is well developed with a specialized knowledge infrastructure, highly integrated with cluster firms.

2.5. Openness

The literature on clusters has traditionally focused on the *local* sources of competitiveness – e.g. local collective efficiency (see [Section 2.3](#)), often neglecting the increasing importance of external actors and sources of high value assets such as knowledge and technology. However, extant research shows that when firms are *too embedded* in local networks, their innovative performance decreases because firms get trapped in ‘redundant’ and therefore poorly innovative ties (Giuliani, 2013). Indeed, extensive evidence on Latin America reveals that both the local and the global dimensions matter and firms often participate in intra and extra cluster networks and both types of networks offer opportunities to foster competitiveness via learning and upgrading (Pietrobelli and Rabellotti, 2007).

A typical channel through which clusters opens up to international markets is exporting part of their local production. It is well known that *exports* offer many opportunities for learning and for improving efficiency - as documented in the literature on ‘learning from exporting’. (see Wagner, 2007 for a survey). The advantages of exporting stand also in the attraction of foreign customers to the cluster, which enhances local EEs. This effect is especially beneficial when there is a critical mass of exporting firms, having acquired a solid reputation in the international market and allowing the circulation of relevant information on foreign markets at the local level. Moreover, the establishment of export consortia or strategic alliances have also been documented as improving JA in clusters (Rabellotti, 1998), while exports often stimulate firms to share the costs for participating in international trade fairs or organizing promotional missions to foreign countries, often through the local business associations (Belso-Martinez, 2006).

Another way through which cluster firms connect to external actors is through *foreign direct investment (FDI)*, both from MNCs investing in the cluster, and from cluster firms

investing abroad. MNCs may have an interest in investing in clusters if they intend to tap into local capabilities and knowledge, as well as to participate in local collective learning and collaborative activities (Porter, 1990; Enright, 2000). From the point of view of local firms, their interactions with MNCs can generate spillovers, imitation effects and stimulate direct innovation efforts, particularly in the case of supplier linkages (Barba Navaretti and Venables, 2004).

The internationalization of local firms and their becoming MNCs is another key channel for opening up clusters, provided that the MNC remains embedded in the cluster. Earlier studies on Italian industrial districts have in fact documented that local MNCs tend to reduce the level of local subcontracting and local connections in general, while at the same time they rely more on external links, also for enhancing their skills and accessing knowledge.

Finally, another important way through which cluster firms connect to external actors is by participating in global value chains (GVCs), which have become a dominant model in the organization of global production (Gereffi, 1999). Humphrey and Schmitz (2002) discuss the opportunities for local producers to learn and access knowledge and technologies through the global leaders of GVC. Accordingly, the involvement of cluster firms in GVCs is considered to enhance cluster firms' innovation performance, because these firms are under strong pressure to comply with the qualitative requirements of chain leaders and to therefore upgrade their product and production standards. However, being part of a GVC does not imply an automatic upgrading for firms, as shown in a study on Latin America by Pietrobelli and Rabellotti (2007). Based on a number of case studies in different countries and sectors, the authors conclude that the mode of governance of the value chain, as well as the sectorial specificities of the cluster influence the extent to which local firms manage to upgrade and how they undertake it.

All in all, we maintain here that the degree of openness of a cluster depends on its exports, on the presence of MNCs in the cluster (both foreign and local), and on local firms' involvement in GVCs.

2.6. *Cluster life cycle*

So far we have considered clusters as static organizations, but they are in fact complex adaptive systems made up of different components with evolving functions and

interrelationships. As argued by Martin and Sunley (2011): “*Clusters come and go; they emerge, grow, may change in complexion and orientation, may undergo reinvention and transformation, and may eventually decline and even disappear. In short, they evolve* (p. 1300).”. Clusters have their own life cycle, which may differ from that of the industry they belong to (Menzel and Fornahl, 2010) – as well documented by the work of Saxenian (1996) about the Boston and Silicon Valley high tech clusters. Other studies have also documented a difference in performance to exist between clustered and non-clustered firms, a difference that varies according to the stage of the cluster life-cycle (CLC) – e.g. clustered firms outperform non-clustered ones at the beginning of the CLC and have a worse performance at its end (Audretsch and Feldman, 1996; Pouder and St. John, 1996). According to Menzel and Fornahl (2010): “*This shows that the cluster life cycle is more than just a local representation of the industry life cycle and is prone to local peculiarities* (p. 206).”.

Menzel and Fornahl (2010) identify four different stages of cluster life cycle, based on four dimensions: (1) a *quantitative direct* dimension that is based on its size measured by the number of actors involved, such as companies and other organizations (universities, R&D centers, business associations, etc.), and by the number of employees; (2) a *qualitative direct* dimension, which refers to intra-cluster heterogeneity in terms of the diversity of knowledge and competencies available among the local actors; (3) a *quantitative systemic* dimension that refers to the innovative environment of the cluster – i.e. individual companies and their innovative capabilities are affected by the action and behavior of other actors in the cluster and the existing opportunities for cluster firms to undertake joint actions; (4) a final *qualitative systemic* dimension measured by the cluster capability to use diversity in terms of exploiting synergies and networking opportunities.

On the basis of these characteristics, they suggest that the CLC is characterized by four phases:

- a) **Emergence**: In emerging clusters there are few companies characterized by rather heterogeneous knowledge basis and competencies, which limit possibilities for local networks and joint action. If there are initial positive conditions such as a strong knowledge base or political support, the emerging cluster becomes a growing cluster and companies reach a critical mass, otherwise it loses its potential for growth;

- b) Growth: A growing cluster is characterized by a strong increase in employment, in the number of cluster companies and in their size. The cluster also becomes more focused and there are growing opportunities for collective action and networking among local actors;
- c) Sustainment: The sustaining cluster is in an equilibrium state. There are two ways in which a sustaining cluster can evolve: a) the decreasing diversity ends in a decline stage; b) new heterogeneity develops within the cluster that creates a new growth phase of a rejuvenated cluster;
- d) Decline: A declining cluster is characterized by a reduction in the number of companies and employees and by being locked into its previously successful path. There are three possibilities for the declining stage of a cluster to end. The first option is the progressive disappearance of the cluster; the second is a renewal of the existing development path, often thanks to the injection of external resources and the third possibility is the transition to a completely different field, with the integration of new external actors.

2.7. Cluster policies

Cluster policies are considered a means to promote economic development and structural change, often by enhancing innovation capacity. In advanced countries, cluster policies have a long tradition and a large diffusion. A survey conducted in 2012 by the European Cluster Observatory (2012) identified 578 cluster initiatives; in the United States the Small Business Administration has launched 40 cluster initiatives, while in Japan the Ministry of Economy, Trade and Industry (METI) supports over 100 clusters, mostly in high tech sectors (Pietrobelli et al, 2103). Cluster policies are also widespread in developing countries, and in particular in Latin America and the Caribbean. They are increasingly adopted by national and regional governments, as well as by international organizations, as a mean for promoting the development of the private sector (Pietrobelli and Stevenson, 2011).

In some cases, cluster policies aim at the promotion of clusters from scratch, by providing a tailor-made context in which firms aggregate, cooperate and generate external economies. A case in point is that of industrial and technology parks. In most cases, however, cluster policies aim at strengthening or promoting existing clusters and different types of policy measures have been applied to clusters depending on their characteristics

and needs (e.g. levels of CE, degree of innovation, CLC). In emerging clusters, for instance, cluster policies have been designed to encourage collaboration among local actors, sustain local firms to become brokers of knowledge or technological gatekeepers or even to facilitate the birth of new enterprises. In growing clusters, policies may instead play a key role in sustaining and enhancing the development of a dynamic systemic context through the support of local universities and R&D centers, as well as through the provision of specialized collective goods such as education and training of skilled human capital. In sustaining and declining clusters, policy is essential to encourage openness and innovation, in a bid to revitalize the local industry, but also to promote its diversification into other more profitable industries.

These examples suggest that cluster policy design needs to be tailored to the specific context of each cluster. Cluster policies need to be flexible and to adapt to local needs. Moreover, they should not be expected to produce immediate results because they often depend on the creation of trustful relationships between local actors and this takes time to occur – a situation that may lead to time inconsistency problems with the political cycle.

Cluster policies consist of different types of policy instruments, among which the following are particularly prominent (OECD, 2007):

- Policies aimed at engaging actors, which include activities designed for trust building, financial incentives for firm networking organizations and sponsoring of firm networking activities;
- Provision of collective services and business linkages, which often entails activities oriented at improving production capacity based on the scale and skills of suppliers, fostering the formation of external linkages and supporting cluster firms' inclusion in GVCs, and supporting SMEs to adopt international standards of production and to training human capital;
- Collaborative R&D and commercialization, which is oriented to programs including increasing industry-university (IU) links, commercializing the results of such collaborative research and ensuring financial support to spin-off firms.

3. Background analysis of the Caribbean economies

In this section, we focus on the main features of the Caribbean economies that can

constrain clusters' competitiveness and could be successfully addressed within clusters. Specific attention is given to the main characteristics of the innovation process of the Caribbean firms and to the different national and regional innovation systems, identifying their strengths and their main weaknesses.

3.1 The Caribbean Business Environment

The Caribbean countries share many common features. This section discusses the context in which clusters in this region find themselves.

The Compete Caribbean beneficiary countries are moving toward regional integration. Most of the countries are members of CARICOM, except the Dominican Republic. The majority of CARICOM countries have joined the CARICOM Single Market and Economy (CSME), with Haiti being a partial member and the Bahamas not participating. Benefits of participation in CSME include free movement of goods and services, a common external tariff, free movement of capital, a common trade policy and free movement of labour. Despite the benefits of integration, the small size of these countries, even when considered as a single unit, means that they cannot drive global markets and must attempt to strategically react to global trends (Erikson and Lawrence, 2008).

A challenge in Caribbean economies has been resistance to change. Persaud (2011) considers the main obstacle to creating change in Caribbean countries as entrenched barriers embedded in their political economy. A major problem is seen to be the high levels of public employees and the limited power of political parties to make decisions that would not be viewed favorably by public sector workers. This system is seen as benefiting members in the middle and upper classes who have connections to people in authority.

While many Compete Caribbean beneficiary countries have high levels of education (Figure 3.1), they experience large levels of emigration of highly qualified people. Based on a survey intended to measure respondents' perception of brain drain, the Global Competitiveness Report 2012-13 ranked several Compete Caribbean beneficiary country out of 144 total countries. The results are Barbados at 24th, Trinidad and Tobago at 56th, Dominican Republic at 59th, Suriname at 64th, Jamaica at 105th, Guyana at 107th and Haiti at 143rd. Specifically, these countries experience high levels of emigration of people with tertiary education, with all but two countries (Dominican Republic and Suriname)

having over 60% emigration rate and five countries (Grenada, Guyana, Haiti, Jamaica and St Vincent and Grenadines) with over 80%.

Caribbean countries lack diversification, entrepreneurship and innovation (Downes and Watson, 2011). Innovation systems require a critical mass of human capital, sufficiently able, skilled, and specialized in science, technology, and innovation. Caribbean countries typically have relatively few scientists, researchers, technicians, or engineers given the size of their economies and populations and those that are present are concentrated in public research institutes and universities (Painter, 2010).

While the Caribbean countries considered in this paper share many features, it is also important to consider the diversity between them. According to the Global Competitiveness Index (Schwab and Sala-i-Martin, 2013), which measures a) basic requirements for competitiveness (i.e. efficient public and private institutions, extensive and well-functioning infrastructure, good macroeconomic fundamentals, and a healthy and literate labor force); b) efficiency enhancers (quality of higher education and training systems; efficient markets for goods and services; flexible labor markets; sophisticated and sound financial markets; size of domestic and/or foreign market allowing for economies of scale; the ability to leverage existing technologies, notably ICT, in the domestic production system) and c) innovation and sophistication factors (a large innovation potential and the use of sophisticated production processes), the countries are at multiple stages of development. Of those that are considered in the 2013-14 report, Haiti is in the first stage of development, four are in the second stage (Dominican Republic, Guyana, Jamaica and Suriname), Barbados is transitioning from the second to the third level and Trinidad and Tobago is in the third and highest stage.

3.2 Balance between Sectors

The GDPs of Compete Caribbean beneficiary countries are generally largely supported by the service sector, which is also the biggest employer (see Figure 3.2 and 3.3). When it comes to exports, the picture is more varied, with a wide range of contributions of goods and services exports to countries' GDPs (see Figure 3.4). Also, it can be seen that the balance between merchandise and service exports varies a lot across countries (see Figure 3.5) and there is quite a wide variety of goods and services exported (Figure 3.6). This section discusses general trends in the role of different sectors in the economies of the Compete Caribbean beneficiary countries.

Caribbean countries cannot compete globally for manufacturing jobs on the basis of low wages as these are higher than competitors in Central America and Asia and the countries' small sizes make it hard to reach economies of scale (Nurse, 2007; Erikson and Lawrence, 2008). However there is potential for niche manufacturing as can be seen, for instance, in the case of medical devices being produced in Trinidad and Tobago (Erikson and Lawrence, 2008).

The small countries in the Caribbean often lack the economies of scale to compete in the production of agricultural products. They can no longer compete in their traditional exports of bananas and sugar (Erikson and Lawrence, 2008). However, food exports are a significant portion of merchandise exports in most of the countries (see Figure 3.6). These countries can particularly benefit from niche products and local specialties that may have broader markets.

Some countries currently benefit from exporting fuel, ores and minerals (see Figure 3.6). Notably Trinidad and Tobago possesses significant oil and natural gas reserves. While these items may continue to provide income in the medium term, they are non-renewable resources and vulnerable to global price fluctuations.

The service sector is the largest contributor to growth in the Caribbean. Excluding Guyana and Trinidad and Tobago, service value added contributes to over 50% of beneficiary countries' GDPs⁵ (see Figure 3.2). Most business services and personal services firms have between 1 and 5 employees (Saavendra 2011). Two particularly prominent services in the region are tourism and business services, which are discussed below.

Tourism is a major contributor to many of the Caribbean countries' economies. The climate and natural environment have a high appeal for international tourists. In 2011, the Compete Caribbean beneficiary countries received 10.4 million arrivals of international tourists (World Bank, 2014). However, the Caribbean's competitiveness in stay-over tourism is slowing down and has not made any significant gains in the total world market share of stay-over arrivals for almost four decades and these countries could benefit from finding new ways to become more competitive (Bolaky, 2011).

Business services also contribute to Caribbean economies. Services that typically surround financial centers, such as asset managers, lawyers, accountants, risk

⁵ Data is not available on service contribution to Haiti's GDP.

managers, and software developers are high value and easy to provide from abroad and are well suited to Caribbean economies (Persaud 2011). Most of the Compete Caribbean countries are English speaking, which creates opportunities to work with large English speaking customer bases such as in the US or Canada.

Another area that is important to consider in Caribbean economies are cultural and creative industries. Caribbean culture gives this region strength in creative industries. In addition to cultural features being a contributor to tourism, the region has much other cultural and creative strength in areas including music, visual and performing arts, fashion and new media. Cultural and creative industries can include products and services. These industries cannot be seen in isolation and can have wide impacts, including adding value to other industries, notably through design, advertising and branding; being major employers of highly skilled people, thus being part of the 'knowledge economy' – that part of the economy which employs graduate talent; contributing to the regeneration of towns and cities; connecting and working with further and higher education; and bringing communities and people together through shared experiences (BOP Consulting, 2010).

3.3 Innovation in the Caribbean

The Latin American and Caribbean (LAC)⁶ region has low total factor productivity compared to other regions (Daude, 2010; Lemarchand, 2010). Additionally, low levels of innovation are found across the LAC region (Ortiz et al, 2012). Productivity gaps between innovative and non-innovative LAC firms have been found to be higher than the gaps found in European countries (Navarro and Zuniga, 2011). Investment in innovation and R&D could improve productivity in LAC countries and could include adopting existing technologies (Painter, 2010; Lasagabaster and Reddy, 2010; Ortiz et al, 2012; Mohan et al, 2014). Notably, a recent study focusing on the Caribbean found that the benefits to investing in innovation do not differ greatly from those found for Latin America (Mohan et al, 2014).

An important factor to explore when considering how innovation happens is institutional support. The LAC region lacks efficient innovation systems and the majority of LAC

⁶ This section is based on empirical evidence about the whole LAC region when specific information about the Caribbean region is not available. Notwithstanding the high heterogeneity within LAC, anyway this should provide some useful indications about innovation in the Caribbean.

countries invest less in R&D than other countries with similar income levels (Lasagabaster and Reddy, 2010). Half of the investment in R&D in LAC countries is financed by private industry, which contrasts with the experience of dynamic global innovators such as China, Korea, and the United States (Lasagabaster and Reddy, 2010).

Strong innovation systems are supported by coordination between business, academia and government. The Caribbean has faced challenges with developing synergies between these three groups of stakeholders. Public policies, regulations, trust and mechanisms for coordination could improve high transaction costs and suboptimal results in the Caribbean (Painter 2010).

One particular area of difficulty has been the lack of cooperation between research institutions and businesses. Past experience has shown that increasing scientific outputs in LAC countries does not necessarily lead to transfer of knowledge from academia to industry and services (Painter 2010). Public funding of research in LAC has emphasized the generation of conceptual knowledge but has been less efficient at energizing technological innovation such as the production of patents (Lasagabaster and Reddy, 2010). Universities and industry face incentives and cultures discouraging productive research collaboration and the resulting low levels of collaboration have hindered the transformation of new knowledge into innovation (Lasagabaster and Reddy, 2010). Investment in R&D is important for successful technology transfer and for firms to absorb external knowledge.

As has been discussed in Section 2.4, the features of clusters often make them places that are conducive to innovation. As stronger relationships between institutions can stimulate innovation, strengthening connection within clusters and local, regional or national innovation systems has the potential to increase innovation. Specifically, providing support for innovation to targeted areas such as clusters has been seen to have more impact than broad spread programs (Feser, 2002; Rodriguez-Clare, 2005).

Following from the discussion in Section 2.4, in terms of clusters promoting innovation, a point to consider is whether clusters in the Caribbean have features, which are conducive to promoting innovation. In a study looking at innovation in LAC firms, Ortiz et al (2012) did not find a connection between innovation and being located in large urban areas for LAC based firms. The study noted that this could be the result of measurement problems,

particularly that the size of the urban area could be an indicator that is too general to capture true economies of agglomeration but also proposed the possibility that these results could indicate an inherent weaknesses in the linkages of local innovation systems.

Another import contributor to innovation can be strong ICT connectivity. This is particularly important for small and isolated Caribbean countries. Internet usage levels vary across the region, with Haiti having the lowest levels at 10.6% of the population being Internet user and St Kitts and Nevis at the highest with 80% of the population using the Internet (see Figure 3.7). Additionally, Caribbean countries have been found to incorporate higher levels of ICT-assisted classroom instruction using computers and the Internet than countries in South and Central America (UNESCO 2012).

Public support for innovation in LAC countries has had a positive impact on several areas. These include using tax incentives to increase business investment in innovative projects, promoting links between companies and universities and improving labor productivity⁷ (Ortiz et al, 2012). However, a recent study by Mohan et al (2014) found that factors, which usually encourage investment in innovation, such as patent protection, public subsidies, or cooperation among innovators, might not be effective in the Caribbean.

In 1988, CARICOM governments adopted a regional science and technology policy whose goal was to integrate and harmonize national policies. The Caribbean Council for Science and Technology (CCST) was designated as the coordinating agency in 2000 and they produced the Regional Policy Framework for Science, Technology and Innovation (STI) in 2007. The framework has nine categories of supporting institutions and mechanisms, which are discussed below.

The first is infrastructure. This item stipulates that member governments will address factors that restrain innovation, such as providing conditions that support innovation and attract foreign investment, including stable macro-economic environments, supportive tax policies, appropriate physical infrastructure, improved public sector efficiency and supportive education and training policies, protecting intellectual property rights, improving synergy between public and private investments in innovation and promoting cooperation between government, industry and academia for technical research.

⁷ Impacts on labour productivity begin to appear three to five years after the start of innovation projects.

Additionally, governments are expected to support institutions that will facilitate the application of science, technology and innovation for socio-economic development.

The second supporting mechanism is policy and planning. This item mandates that countries will develop policy statements, strategic plans, processes for the review and evaluation of results; establish focal points for coordination at the national level and contribute to regional activities; develop statistical indicators to measure benchmarks for science and technology in industry and education; and put in place suitable mechanisms through which governments decision making, policy formulation, planning and implementation will be shaped through independent scientific advisement.

The third supportive instrument is development finance. Under this provision, governments are expected to reach the target of having at least 3% of GDP in active R&D programs.

The fourth one involves governments promoting measures that enable societies to make better use of intellectual capital to generate greater levels of innovation and develop new technologies. Under this category, governments are expected to create linkages for translating knowledge into business development and solutions to social problems.

The fifth mechanism is standardization. This involves promoting compliance with the growing range of regional and international technical regulations and standards.

The sixth one is supporting human resource development.

The seventh mechanism ensures that curriculums place enough emphasis on science and technology education.

The eighth instrument is research and development. Governments are expected to integrate science and technology research areas. Strategies for this item include: the development of national and regional research institutes and overarching research management plans; encouraging linkages between institutions; encouraging the development of mechanisms to transfer research results in to commercial applications; improving access to information; encouraging research in areas with knowledge gaps; encouraging the involvement of multiple stakeholders in research; encouraging results-oriented research as opposed to publication-oriented research; and, developing mechanisms for identifying, valuing and making use of traditional knowledge and indigenous technologies.

The ninth supporting mechanism is a regulatory framework and intellectual property rights. This mechanism involves promoting creativity and innovation through the use of intellectual and industrial property rights. Additionally, governments are expected to ensure that regimes for copyrights and patents, environment and health and standards for product performance and compatibility are modernized.

Additionally, the Caribbean Council of Science and Technology has collaborated with Special Multilateral Fund of the Inter-American Council for Integral Development (FEMCIDI) of the Organization of American States (OAS) and the Technical Centre for Agricultural and Rural Cooperation ACP-EC (CTA) to fund projects throughout the Caribbean region aimed at encouraging greater innovation and entrepreneurship and improved communications between key stakeholders, concentrating on R&D, policy making and private sectors. These projects are complementary to national initiatives run by organizations including the National Institute of Higher Education, Research, Science and Technology (NIHERST) in Trinidad and Tobago, the National Council for Science and Technology (NCST) in Barbados, and the government of St. Vincent and the Grenadines. There are also several regional organizations, which aim to foster collaboration between science, technology and innovation activities across the Caribbean; these include the Caribbean Academy of Sciences (CAS), the Caribbean Scientific Union and the UWI-CARICOM Project.

In terms of national innovation systems, Compete Caribbean beneficiary countries have a variety of institutions whose mandates include promoting innovation. The strength of these systems varies across the region. Details on the structures of the national innovation systems are described in Appendix 1.

The remainder of this section focuses on the characteristics of innovation in Caribbean firms. Innovation activity in LAC is concentrated in incremental changes bringing something new to individual firms, which may not be new internationally or even domestically (Painter, 2010). Innovation expenditure is concentrated in purchasing machinery with advanced technology (Painter, 2010).

Differences can be found between firms that innovate and those that do not. In LAC, firms that invest in R&D or innovate are more likely to patent and have a stronger presence in international markets. These effects are stronger for product than process innovation (Ortiz et al, 2012). Innovation activities are strongly associated with firm size in

LAC, with small and medium firms being less capable of innovation, which limits their potential to grow and be internationally competitive (Ortiz et al, 2012).

Innovation in the Caribbean faces numerous challenges. LAC firms seem to have little in-house R&D capacity (Painter 2010). Some large Caribbean firms choose to produce products that are licensed from foreign firms for sale in domestic markets (Nurse 2007). Another problem in LAC is that small and young firms face greater difficulty in accessing financing for innovation (Tacsir et al 2012).

Additionally there are certain features that can be identified related to innovation of foreign firms operating in the Caribbean. One is that foreign firms seem to concentrate their R&D in their home countries and not in Caribbean branches (Ortiz et al, 2012; Mohan et al, 2014). Another issue with innovation in the Caribbean is foreign ownership of patents. For example, in Trinidad and Tobago, over 95% of the patent applications are from non-residents (Nurse, 2007). While it has been found that foreign firms in the Caribbean introduce more innovative techniques than domestic firms, this may create the opportunity for spillovers to local firms (Mohan et al, 2014).

As services are a major component of Caribbean economies, innovation in services is an important consideration. Service businesses in the Caribbean range from low-tech personal services to knowledge-intensive businesses services. Some features of the service sector that shape how innovation happens are low levels of capital equipment, discontinuous production processes, a limited role for economies of scale, and the immaterial and information-intensive nature of the product that makes storage and transportation difficult (Tacsir et al, 2011). Service innovation can be supported through ICT capital, software, training, marketing investments, knowledge acquisitions, informal arrangements along with regulations and tax structure (Tacsir et al, 2011).

In addition to benefiting service-based businesses, tertiary innovation can also improve competitiveness of agriculture and manufacturing firms as it can transform any industry (Rubalca 2013). Despite the great potential for service innovation, a study by Mohan et al (2014) found that innovation in the Caribbean is primarily carried out in the manufacturing sector.

4. *How clusters can be classified?*

This report is based on a desk review of 32 cases of Caribbean clusters. The survey of these cases was based on two sources. First, we have relied on the material provided by the institutions promoting this report – i.e. the Inter-American Development Bank and Compete Caribbean – which have suggested a large part of the cases in the analysis. Second, we have carried out an additional search of academic studies, policy-reports and grey literature available through different sources and often available online on the web page of acknowledgeable institutions. Next, key informants have assessed the validity of our search and have provided support to the fact that our cases are representative of the diversity of clusters in the region.

The cases include examples from the main industries in the Caribbean economies: natural resources based industries, comprising agriculture, agro-processing, forestry, aquaculture and energy; manufacturing; and services, embracing tourism and creative industries. They are located in several countries among the beneficiaries of the Compete Caribbean program: Barbados, Belize, Dominica, Grenada, Guyana, Jamaica, St-Lucia, St-Vincent & Grenadines, Suriname, Trinidad and Tobago,

The empirical evidence collected (see Appendix 2 for the full list of documents) has been carefully analyzed along six cluster dimensions that we consider influencing their competitiveness (see Figure 4.1), on the basis of prior academic work (discussed in Section 2). Each dimension has been assessed on quali-quantitative grounds – i.e. based on a very detailed analysis of the text, we have measured each dimension quantitatively (typically using Likert scales or other categorical classifications). In reviewing the documents about the cluster case studies, we have taken into consideration the context presented and the specific wording, trying to minimize the occurrence of biases and misinterpretations complementing and cross-referencing information in all possible ways. To reduce subjective interpretation and biases, two different persons have read the case studies and have independently assessed each case on a quantitative ground. Discordant cases have then been further analyzed until a decision has been made for each case.

In any case, as with any study of this kind, there may be potential problems related to the accuracy of the results, which therefore calls for cautious interpretations.

In what follows, we describe in details how each dimension is measured. Table 4.1 provides a summary.

The Cluster Structure

Under this dimension, the Caribbean clusters are characterized along three sub-dimensions:

- a) *Sectorial specialization* by specifying the main sector of activity (e.g. agro-processing, tourism, creative services);
- b) *Geographical boundaries* by distinguishing among urban, local, national and inter-Caribbean clusters; and
- c) *Organization structure* by distinguishing among survival, Marshallian and hub-and-spoke clusters.

Collective Efficiency

Clusters are characterized along two sub-dimensions (Giuliani et al, 2005):

- a) *External Economies*, specified as specialized labor market; availability of inputs; access to information; market access); and
- b) *Joint Action*, namely backward and forward linkages, horizontal bi-lateral linkages (i.e. cooperation between firms working at the same stage of the value chain) and multi-lateral linkages (i.e. cooperation that involves firms, public, public-private organizations at the local level, local associations, chamber of commerce, NGOs, or any other local actor, including universities, research centers).

To quantify the degree of CE, we have carried out a careful evaluation of its main components (EE and JA). The intensity of EE and JA in each cluster is classified on a 5-point Likert scale, reflecting the following levels of both EE and JA intensity: *Low (1), Medium/Low (2), Medium (3), Medium/High (4) and High (5)*. Once a Likert point has been attributed to each of the sub-dimensions of both EE and JA (e.g. bilateral vertical JA, bilateral horizontal JA, and multilateral JA), we have taken the average value as synthetic indicator for EE and JA.

Innovation Capacity

We codify cluster *Innovation Capacity* using a 5-point Likert scale, as follows: *Low* (1), *Medium/Low* (2), *Medium* (3), *Medium/High* (4) and *High* (5). Under this item, we considered and coded four sub-dimensions:

- a) The knowledge and technological base of the cluster firms;
- b) The intra-cluster knowledge system;
- c) The extra-cluster knowledge system;
- d) The innovation system.

We measure cluster Innovation Capacity as the average of the values attributed to each of the four items above.

Openness

This dimension aims at classifying clusters on the basis of how open they are. Three main channels are considered:

- a) Export orientation, classified as *Absent*, *Low*, *Growing*, *Medium* and *High*
- b) Presence (YES or NO) of MNCs in the cluster (both foreign and local)
- c) Cluster firm participation in (YES or NO) in Global Value Chains.

On the basis of this information, we classify clusters as:

- Closed Cluster: No or weak evidence of the cluster being connected to international actors. Closed clusters do have no or very low export orientation, no MNCs and their firms do not participate in a GVC;
- Closed-Opening Cluster: Evidence of the cluster starting to be connected to international actors, growing export orientation, but no MNCs, nor GVC participation of cluster firms;
- Semi-Open Cluster: Medium to high export orientation and some evidence of the cluster being moderately connected to international actors;
- Open Cluster: Evidence of the cluster being strongly connected to international actors, medium to high export orientation, and cluster do either host a MNC or their firms participate in GVCs (or both).

Stages of the Cluster Life Cycle

We consider the two following sub-dimensions:

- a) The size of the cluster based on the number of actors involved;
- b) The system's characteristics, considering the degree of joint action (see CE)

in the cluster and the existence of open networks and channels for accessing external knowledge (see Innovation Capacity).

Adapting from Menzel and Fornahl (2010), based on these two sub-dimensions and also considering the historical information available, four stages of the cluster life cycle (CLC) are identified:

- Emergence: a) Small number of actors; b) Low or Low/Medium Joint Action and Semi-Open Knowledge Networks;
- Growth: a) Increasing number of actors; b) Medium or High Joint Action and Open Knowledge Networks.
- Sustainment: a) Large number of actors; b) Medium or High Joint Action and Open or Semi-Open Knowledge Networks;
- Decline: a) Large number of actors; b) Low or Low/Medium Joint Action and Closed Knowledge Networks.

The Role of Policies

In this dimension we classify clusters on the basis of whether their formation or development has been promoted by policy interventions. We thus suggest the following classification:

- Spontaneous cluster: no sign of policies for the establishment or development of the cluster;
- Cluster with policy from inception: the cluster has been set up from scratch through policy interventions (either by the State or by other international organisms);
- Cluster with policy for development: the cluster development process is supported by cluster policies.

5. *The Caribbean clusters*

Based on the key cluster dimensions discussed in Section 2 and operationalized in Section 3, we provide here an overview of the main characteristics of the 32 Caribbean clusters that have been surveyed for the report. Table 5-1 provides a summary of the cluster characteristics. In Appendix 2, we provide a list of all the documents carefully reviewed and on which our empirical analysis is based.

5.1. Cluster Structure

Table 5.1 presents the classification of the Caribbean clusters according to three dimensions: their sector of specialization, their geographical boundaries and their organization structure (see Section 2.2).

a) Sectorial Specialization

The *sectorial dimension* of the clusters reflects the dominant economic structure of the Caribbean region, and is characterized by the predominance of the tertiary industry and by the exploitation of natural resources, with only two clusters exclusively specialized in manufacturing.

Clusters in the tertiary industry mainly specialize in tourism, often exploiting certain natural resources available locally – see the cases of eco-tourism clusters targeting new market niches such as bird watching or the catch and release fishing in Guyana and the geo-tourism cluster in Grenada. Besides tourism, clusters in the creative industries are present in the region and they exploit the rich cultural heritage in music, visual arts and popular traditions, such as the carnival in Trinidad and Tobago. Attempts to build up new specializations in the creative industry, such the animation industry in Barbados, Jamaica and St. Lucia, are also worth mentioning. They represent an attempt to establish clusters involving different forms of creative activities; a case in point is the creation of a multimedia center in Barbados. Finally, the tertiary industry also includes a number of clusters operating in the financial and business service industries, as well as in the maritime services.

Clusters in natural resource based sectors are numerous. These include clusters specialized in agricultural products, such as nutmeg production in Grenada; non-traditional products, such as fruits and vegetables in Guyana; as well as agro-processing clusters, including the production of coconut water in Guyana and processed food in Trinidad and Tobago. Worth mentioning is also a pulp and paper (forestry) cluster in Guyana, where firms specialize in the production of floors, decks, furniture and other wood products. Moreover, we have identified a set of clusters specialized in aquaculture, such as fish farming in Guyana, shrimp breeding in Belize and ornamental fish in Jamaica. Finally, two key natural resource-based clusters in Trinidad and Tobago are centered on oil and gas production and related services and manufacturing activities.

As said, the specialization in manufacturing goods is not very common among clusters in the Caribbean region. We have included only two manufacturing clusters: gold jewelry in the gold rich Guyana, and rum production in most of the Caribbean countries.⁸

b) Geographical Boundaries

Given the very small/small insular dimension of Caribbean countries, half of the clusters under consideration have been classified as *national*, involving economic actors and institutions located in different parts of the same country. The *local* dimension is predominant in agricultural clusters (for the territorial nature of specific crops), as well as in tourism – with some sub-national areas being promoted such as the Upper Suriname River Region in Suriname and Treasure Beach in Jamaica. The pottery cluster aggregating micro and small artisanal firms in Trinidad and Tobago has also been classified as sub-national.

Urban clusters are in the service industry, and include financial and business services, as well as retail in Trinidad and Tobago. In Jamaica there is an urban cluster specialized in ornamental fish breeding.

Finally, we would have expected a wide diffusion of inter-country clusters, as the Caribbean region is small as well as its member countries, whose economic systems are most probably not able to guarantee scale economies for cluster firms. Nevertheless, the limited cooperation and the lack of inter-regional economic linkages is one the key problem in this area, and this is reflected by the small number of inter-Caribbean clusters we found in this study. Among the inter-Caribbean clusters we found the production of coconut water involving small producers in Guyana and a large agro-processing firm in Trinidad and Tobago. The production of rum is also diffused in most of the countries in the region and there is an inter-Caribbean cluster involving small local producers, large multinationals, local business associations and service providers. A similar organization is observed in a cluster specialized in maritime services, involving St-Lucia, Dominica, St-Vincent & Grenadines, and Grenada. Finally, there is a cluster in the animation industry involving studios in Barbados, Jamaica and St. Lucia.

c) Organization structure

In terms of organization structure, we have distinguished between survival, Marshallian, and hub-and-spoke clusters. The most common organization structure across all sectors

⁸ We are aware of the existence of other manufacturing clusters (OTF Group, 2010) but the information available is not sufficient for including them in this analysis.

and countries is the Marshallian cluster, characterized by the presence of firms of different sizes (although they are mostly small), and by local input producers, service providers and supporting institutions. The Marshallian clusters in our study are very diverse and rather different from the typical Marshallian cluster common in advanced countries and usually characterized by intense external economies and diffuse joint action. Among the clusters investigated here, there are cases in which the number of economic actors involved is very small, such as the catch and release fishing cluster in Guyana where there are only a few lodges, one tour operator and a small bunch of other supporting organizations and service providers. Other clusters are more complex and involve a larger number of organizations, such as the oil and gas production in Trinidad and Tobago, where firms operate at different stages of the value chain, from oil exploration and extraction, to the manufacturing of petrochemical products and the provision of specialized services. Moreover, business associations and several public agencies provide support to the cluster. There are also clusters in which the organizational model has Marshallian characteristics, while also including elements of a hub-and-spoke structure. This is the case of a large forestry cluster in Guyana in which there are different components: many small and medium companies operating like in a Marshallian cluster working alongside a hub firm - a large Malaysian MNC – connecting local producers to the external market. For the sake of classification simplicity, we have classified this cluster as a Marshallian one but in the analysis we should keep in mind that among the clusters investigated there are some hybrid organizational models.

The hub-and-spoke model is found in the coconut water cluster in Guyana where many small farmers and a few larger farms sell coconuts to three processing plants, one of them being a large company from Trinidad and Tobago that plays a leading role in the cluster. A similar organization structure characterizes another cluster in Guyana producing fruits and vegetables in which an Israeli company acts as a hub and organizes the production and export activities of the local farmers. In the ornamental fish cluster in Jamaica, the hub is an NGO connecting the breeders and growers to the external market and providing specialized services, such as quality and traceability management, marketing, packaging and shipping, as well as advocacy to the small producers. In Barbados, the hub is a multimedia center playing the role of distributor agency and promoting different local creative activities in the field of audiovisuals, fashion, music, visual arts, publishing and culinary art. In the large and complex inter-Caribbean cluster specialized in maritime services, there are two very different components: one part of the

cluster is dominated by a few large international shipping lines providing services from the USA and Europe to their regional hubs in Barbados and Trinidad. Yet on the other islands the cluster can be defined as a survival cluster composed of largely informal, small vessels that ply their trade services within the Caribbean islands. This is another case in which there is a hybrid organization structure, in this analysis classified as hub-and-spoke on the basis of the dominant pattern.

Finally, only one cluster has been classified as survival, and this is the cluster producing pottery in Trinidad and Tobago, which is composed of a bunch of small artisanal firms, many of them being informal and mainly producing for the local market. It is worth mentioning that in developing countries survival clusters are very common and the reason why we have met only one of them in our sample is likely due to the fact that these clusters often subsist below the radar of policy makers and researchers.

5.2. *Collective Efficiency*

Table 5-2 presents the detailed information available on the different elements of collective efficiency in the clusters investigated in this study.

5.2.1 External Economies

External economies are the first component of collective efficiency. We have assessed their presence in the following main areas: availability of qualified labor resources; the easy accessibility of inputs; access to information and to market

(a) *Qualified Labor Resources*

In the clusters investigated, the quality of the local labor market is very diverse. Clusters specialized in energy, financial, business and maritime services in Trinidad and Tobago and in Jamaica benefit from a very good local availability of skilled resources - also thanks to the existence of specialized master degrees at the local universities, as well as to public programs aimed at training young people in the required competences. In contrast, the labor market in the part of the maritime cluster dominated by small informal vessels and involving the small island countries of St-Lucia, Dominica, St-Vincent & Grenadines, and Grenada, displays a severe lack of qualified human resources. In this cluster, the vast majority of vessel crews have received very limited formal training in key areas such as seafaring and business administration. A survey of the cluster conducted in 2010 found that approximately 80% of the crewmen on the vessels inspected had not

completed a Basic Safety Training course, which is a requirement of compliance for the Standards of Training and Certification within the Watch-keepers (STCW) Convention (OECS Secretariat, 2013).

There are several other clusters in sectors such as agriculture, manufacturing and tourism in which the qualification of labor resources is rather low. Two cases - the birding cluster in Guyana and the animation cluster in Barbados, Jamaica and St. Lucia - show how the development of a competent and qualified local labor force can become a key resource for cluster growth. In Guyana, GTIS (Guyana Trade and Investment Support), a USAID funded program, has trained local people in bird watching, ecotourism and indigenous best practices, creating a critical mass of skilled local human resources, key for the entry of Guyana in this new segment of the tourism market (CARANA Corporation, 2009). In the animation cluster, government agencies and training institutions in both Barbados and Jamaica are investing in the building up of competences in this new sector of specialization and several educational institutions are starting to develop specialized curriculums to provide advanced qualification in the field.

(b) Input Availability

Input availability is key in natural resource clusters, like those specialized in the energy industry in Trinidad and Tobago and those in aquaculture in Guyana, Belize and Jamaica. In the shrimp cluster in Belize, the existence of well-run local hatcheries for the post-larvae phase is considered to be a key competitive advantage in the local industry. Similarly in the production of ornamental fish in Jamaica, the local availability of inputs such as feed, chemicals, and packaging products represents an important element of competitiveness in the cluster. While in some clusters input availability is strength, there are other cases where bad infrastructural conditions limit the accessibility of cluster firms to inputs. A case in point is the nutmeg cluster in Grenada, where due to poor port facilities, many farms may remain inaccessible for long periods of time after hurricanes. A similar condition is found in Treasure Beach in Jamaica where roads are in poor conditions and the water supply is often unreliable and inadequate. Also in the inter-Caribbean maritime cluster, the limited availability of key inputs is a constraint to the cluster development: in the countries involved, there is a diffused infrastructural problem in accessing adequate warehousing and a lack of refrigerated capacity both in ships and in warehouses, as well as inadequate specialized services such as insurance and cargo handling.

Availability of inputs is limited in clusters in which the majority of raw materials and components are imported and depend on world market price fluctuations. In the paper and packaging cluster in Jamaica, inputs such as paper, resin and ink are all imported and importers are unable to buffer fluctuations and negotiate better prices as their individual quantities are often too small (Gannes, 2013).

(c) Information

Information sharing within the investigated clusters is in general very good. For instance, in the shrimp cluster in Belize, information circulates thanks to frequent visits and contacts of small local farms to larger companies and in some instances, farms lend each other specialized employees. The labor mobility is indicated as a key channel to access specialized information in a number of clusters, among which includes the printing and publishing cluster in Jamaica.

(d) Market Access

Finally concerning market access, the poor situation of infrastructure in many clusters in the region represents an obstacle, nullifying the possible advantage deriving from clustering. In a number of cases - such as in the non-traditional agricultural clusters in Guyana and in the Upper Suriname River Area cluster - the recent road improvements have allowed improved market access. However, in this latter cluster, the local companies complain because they are unable to take advantage of the cluster effect, given that most of them still promote their individual lodges instead of internationally marketing the cluster as a whole.

5.2.2 Joint Action

In clusters, joint action takes place along backward and forward vertical linkages, bilateral horizontal links between companies and multilateral linkages within business associations and other supporting institutions.

(a) Backward and Forward Vertical Linkages

In the Guyanese cluster specialized in non-traditional agricultural products, vertical linkages are very well developed in particular in the field of logistics. Some of the farmers are located in remote areas and through joint action the cluster has addressed transportation and logistics obstacles, including the high cost of refrigerated containers, through a partnership with a Caribbean based cargo company interested in growing its

refrigerated container business. Because of this collaboration, the company has agreed to charge the farms in the cluster the rates typically reserved for high volume business. Also, collaboration with a regional freight company resulted in the construction of a cold storage facility for fresh fruit and vegetable exports. The aquaculture cluster, making an interesting case of inter-cluster collaboration, also uses this facility.

In the Guyanese hub-and-spoke coconut water cluster, cooperation is observed between the hub processing company and the coconut producers. The leading company offers technical support to farmers, as well as donations of key equipment and, in some cases, it has provided financial support through cash advances and the guarantee of remunerative prices. In exchange of this wide support, the farmers invest in quality upgrading of their products. Another example of vertical joint action is found in the shrimp cluster in Belize in which there is cooperation between firms with hatcheries and processing facilities and those that do not have them.

In the Barbadian creative cluster we found strong vertical linkages among cluster firms, cooperating on large projects on the basis of their different specialization. For instance, a company producing a music video may collaborate with production houses, dancers and designers, hire a historic location and use the services of a publishing company for the production of promotional material. In co-production, cluster firms may co-fund projects, sharing the risk and the responsibility on the basis of the amount of capital invested.

(b) Horizontal Bilateral Linkages

In the non-traditional agricultural cluster, there is an interesting case of horizontal bilateral collaboration between some small farms and the leading Israeli company, which provides training in up-to-date cultivation techniques and farm management to improve the quality and quantity of yields. These farmers are able to combine their limited production with the larger volumes produced by the hub company, exporting in the international market.

Other forms of horizontal cooperation can be found in the cluster producing coconut water in which coconut producers' work together on key tasks such as sharing the same harvesting teams. In Belize, the shrimp farms regularly share materials, such as ice, hairnets and chemicals.

Bilateral collaboration is facilitated by the existence of a high level of trust among the local actors. This is the case in the catch and release tourism cluster in Guyana in which

the main actors have a long tradition of collaboration and the cluster was created based on the positive experience of some lodges having worked together for a long time. The different lodges offer diversified experiences (i.e. savanna, wetlands and rain forest) and therefore they offer packages to tourists including overnight stays in each of them. This experience somehow contrasts with the Upper Suriname River Area cluster in which there is not a tradition of collaboration and the low degree of collective action is a key constraint to the cluster's competitiveness. One of the major complaints in the cluster is that there is not joint promotion of the area and of the local Maroon culture. Local entrepreneurs pursue individualistic strategies when they sell in international markets. Given the remoteness of the area and the associated high transport costs, the lack of coordination among the lodges impacts on prices, which are therefore extremely high, and potentially not competitive with alternative locations. The lack of coordination on scheduling, as well as the absence of collaboration on transportation and the sharing of other costs represent a constraint to the further development of the cluster.

(b) Multilateral Cooperation

Multi-lateral cooperation is particularly pronounced in the aquaculture clusters. In all the three clusters analyzed for this report, the need to address the environmental impact of this activity has pushed cluster firms to engage in multilateral cooperation. In Belize, the establishment of an association involving all the operating farms has been key for promoting the successful adoption of environmental standards in shrimp production, and for addressing the many environmental challenges involved in the fulfillment of international standards. A similar role is played by the National Aquaculture Association of Guyana, which provides technical support to farmers, plays a key role in the policy dialogue between the industry and the government and guides the strategic planning of this emerging industry.

Another industry in which environmental issues are key collective questions to be addressed within the cluster is forestry. In Guyana, GFC (Guyana Forestry Commission) plays a key role in establishing control over the forestry industry through collaboration with the Amerindian population and with the private companies, also providing training services and marketing support.

In the Grenadian tourism cluster, a key role played by multilateral cooperation is the joint procurement of energy, as the high costs of energy are one of the major barriers to the

sector's growth and competitiveness. GHTA (Grenada Hotel and Tourist Association) is a non-profit organization that represents the private sector in the island's tourism sector, which has set up a project, funded by Caribbean Development Fund for joint procurement of LED lights and solar panels in addition to promoting an energy audit, which will help to identify the quantity required by each company. GHTA is also providing educational opportunities for industry workers and assisting private actors in the development of cultural activities and joint marketing initiatives.

A final consideration concerning multilateral joint action comes from the inter-Caribbean rum cluster in which cooperation among companies, associations and institutions existing in the different countries is clearly hampered by the language differences. There is a regional association of distilleries, the West Indies Rum and Spirits Producers' Association, which started out in the late 1960s as an association founded by rum producers in larger English-speaking countries and then expanded gradually to encompass other Caribbean countries and finally also the Dominican Republic and Haiti. The association provides technical expertise and information about international trade rules but it clearly appears that the Dominican producers have traditionally been cooperating more with companies in Spanish-speaking Central America and that there is not cooperation going on between producers in the Dominican Republic and in Haiti, despite being located in the same island.

5.3. *Innovation Capacity*

Table 5-3 summarizes the empirical evidence available about the innovation capacity in the Caribbean clusters under investigation. The first two columns present an assessment about the knowledge base of the cluster firms and the development of the intra-cluster knowledge system. Among the clusters characterized by a high knowledge base and a dense knowledge system, there are the two energy clusters and those specialized in maritime, creative, business and financial services, all located in Trinidad and Tobago. These are all clusters characterized by a skilled labor force and in which there is a variety of companies with high capacities in knowledge and innovation that are embedded in the local knowledge system in which companies interact with universities, public institutions and active industry associations.

A medium knowledge base characterizes the printing and publishing cluster in Jamaica in which the intra cluster knowledge flows are very dense thanks to high labor mobility

among firms. Attracting experienced workers from well-established companies in the cluster, young and dynamic firms are able to rapidly improve their production processes. Labor mobility is also considered as a major driver of the intra-cluster knowledge system in the shrimp cluster in Belize, which is characterized, as the other clusters in the aquaculture industry, by a medium knowledge base.

In agriculture and tourism there are a few clusters with a weak knowledge base and relatively unskilled human resources. Other weak clusters are those specialized in pottery and retail in Trinidad and Tobago. In these clusters, there are not leading firms that facilitate knowledge access to smaller firms and the local innovation system is rather underdeveloped.

The existence of channels through which clusters are interconnected with non-local, external knowledge is a key component in their innovation capacity (Column 3 in Table 5-4). Clusters can tap into external knowledge sources through the channels maintained by their hub companies. In the Caribbean clusters, this is the case of the non-traditional agricultural cluster in Guyana in which an Israeli company with an important local investment plays this role. Similarly, in the Guyanese forestry cluster international investors also provide key technical assistance and access to knowledge, so that local companies manage to improve their production practices and to meet international quality standards. Accessing knowledge through international companies also occurs in the regional rum cluster and in the coconut water cluster in Guyana.

The shrimp cluster in Belize is externally connected through its involvement in a GVC. Belize shrimp growers are, collectively, a small player in the international shrimp market. They are therefore not suited to serve the giant retail distributors of the major markets, but they have managed to enter into a relatively small Canadian value chain. Their involvement in this value chain and the related need to obtain standard certifications represents a key incentive for innovation in the cluster. To meet this requirement, the national industry association has played a crucial role being very active in promoting the participation of local shrimp producers at international conventions and attending trade fairs,. These events have been critical steps in the development of the cluster, since they have facilitated the local diffusion of information about marketing and about the adoption of international best practices.

In the Jamaican printing and publishing cluster, there is a group of ten to fifteen local leading companies, which are knowledgeable about new technologies and product

development. These firms have developed strong linkages with foreign equipment manufacturers and technicians, who often offer them valuable training in process and product R&D. Similarly in the tourism cluster in Grenada, the access to external knowledge is through the acquisition of world class technical expertise, especially in the areas of branding, marketing, social media and eco-tourism.

Column 4 in Table 5-3 assesses the degree of development of the innovation system in which the clusters are embedded. In the forestry cluster in Guyana there is a very well developed innovation system, which is orchestrated by the Guyana Forestry Commission (GFC) with the assistance of a number of international donors. There is a national technical institute providing programs for specialized training of the workforce and also doing research in the areas requested by the local industry. The Guyana forestry cluster is also involved in international forest ecology research, largely undertaken by Trobenbos, a Dutch based NGO with a focus on nature management and conservation.

A well-developed innovation system can also be found in the three aquaculture clusters in which the existence of supporting institutions represents a key condition for the management of environmental issues, which are key for the survival and growth of the industry. In the three clusters, collaboration among all the relevant stakeholders along all the levels of the supply chain is an important condition to develop and implement industry-wide environmental and social standards, and to eliminate the negative impacts of fish farming. The active collaboration among companies, industry associations and relevant Ministries is also key for promoting a legal framework aimed at respecting the environment and regulating the use of natural resources. In Jamaica, to improve data accessibility there is a system combining mobile, web and GPS technologies to collect, manage and store information on fish stock across the cluster in terms of species, variety and size.

5.4 Openness

The openness of the Caribbean clusters is assessed based on three different dimensions: export orientation, the presence of MNCs and cluster involvement in GVCs. The available empirical evidence on the cases investigated is summarized in Table 5-4.

There is an important result coming out from the analysis of the clusters specialized in agriculture: the export orientation of the clusters depends on the local presence of MNCs

and/or their involvement in GVC. Among the agricultural clusters, the non-traditional agriculture cluster in Guyana has high export orientation thanks to a large investment of an Israeli hub firm, which provide training, packaging and storage services to small local producers. They achieve collectively the critical volumes required to fill large export orders. Similarly, in the coconut water cluster, the foreign market (i.e. mainly Trinidad and Tobago and other Caribbean islands) is reached thanks to the presence of a processing company based in Trinidad, which controls important distribution networks abroad.

An analogous pattern can be identified in the Guyanese forestry and regional rum clusters, characterized by the presence of several MNCs. In both clusters, export orientation has increased thanks to the establishment of joint ventures between foreign and local companies or to the acquisition of local firms by foreign MNCs – e.g. the case of two rum companies in Barbados and the Dominican Republic. The possibility to make use of the MNCs international distribution networks results in a large increase in export sales.

Also in the creative industry, the involvement in a GVC led by a MNC can represent a key channel for opening the cluster to external knowledge and other valuable assets. This is the case of the cluster in Barbados, which has collaborated with Sony Pictures to development of a documentary series and on the first Caribbean 3D movie.

In the tourism clusters, the openness depends on the involvement of international tour operators. This has worked very well in the recently established bird watching cluster in Guyana in which the involvement of 40 international tour operators has attracted a large critical mass of international tourists in a very specialized market niche. A different pattern is found in the Suriname cluster in which local tour operators have sales offices in the Netherlands, which is by far Suriname's most important tourism market.

In the cases of the maritime, financial and business services clusters in Trinidad, the international market is mainly the regional one in which the local companies are regarded as the ones providing the best and most advanced services. In the maritime services, Trinidad and Tobago has evolved into a regional shipment hub offering services to the smaller islands in the region. Similarly, in the financial services Trinidad and Tobago is considered as the financial capital of the region, where many companies come to raise capital both in the bond and equity markets.

5.5. Stages of the life cycle

Table 5-5 summarizes our classification of clusters according to their stages of the life cycle.

(a) *Emerging Clusters*

We found evidence of many clusters in the emerging phase. Many of them are in the tourism industry, - i.e. in Guyana, Suriname, Jamaica and Trinidad and Tobago. These clusters have recently entered into new specialized market niches (see the bird watching tourism in Guyana mentioned earlier, or the other off-the-beaten-track locations like the Carapichaima cluster in Trinidad, Treasure beach in Jamaica and the Suriname Upper River Area). Emerging clusters are also often in the creative industry: both the cluster in Barbados and the inter-Caribbean animation cluster are very recent and still in their emerging phase.

(b) *Growing Clusters*

A large number of clusters are growing: all of the agricultural clusters as well as most of the aquaculture clusters – with the exception of the Jamaican cluster, which is still in the emergence phase.

(c) *Sustainment Clusters*

The financial services cluster can be considered in an equilibrium state, here defined as sustainment. Other clusters, such as the energy one in Trinidad and Tobago and the production of rum in several countries in the region, are well-established clusters, specialized in traditional industries in the Caribbean area, which can also be considered in the sustainment phase.

(d) *Declining Clusters*

Finally, the pottery cluster in Trinidad and Tobago is at a stage of decline due to poor business operations, low technology and very limited quality upgrading. This cluster is approximately 100 years old and it shows many difficulties in maintaining and improving local skills, which are embodied in aged people, whereas younger generations are not very interested in the cluster activities because of the perceived lack of good market prospects.

5.6. Cluster Policies

(a) Spontaneous Clusters

About 20% of the clusters analyzed for this report are *spontaneous*, which means that their emergence and further development have not been stimulated by specific cluster policies. Among the spontaneous clusters, we mention here gold jewelry production in Guyana, which appears as an agglomeration of mainly small companies whose growth is hampered by the lack of an adequate intellectual property protection policy, which Guyana, unlike other Caribbean countries, has failed to enact and ensure compliance. This contextual obstacle does represent a deterrent to future growth in the cluster, with a critical mass of actors showing difficulties in their market positioning. Another spontaneous cluster in which a lack of policy has resulted in decline is the pottery cluster in Trinidad and Tobago. Its origin can be traced back to Indian culture and the cluster has remained an agglomeration of small, often informal, artisanal activities with limited market opportunities and a recent difficulty with transferring tacit knowledge and artisanal skills to the new generations.

(b) Clusters with Policy for Development

Contrary to these two cases, there are other spontaneous clusters in which policy interventions have been implemented to strengthen the original agglomerations. An interesting case is the ornamental fish cluster in Jamaica. In this country, ornamental fish farming dates back to the 1970s as an informal activity with very limited commercial opportunities. In the early 2000s, there was an attempt to launch a farmers' association to transform ornamental fish farming into a commercial venture, but it failed due to internal politics, poor quality production and external negative conditions (i.e. several hurricanes caused great damages to the industry). In 2005, The Competitiveness Company (TCC) identified ornamental fish farming as an informal sector with great potentialities, which could be transformed into an opportunity for income generation for urban youth and unemployed people. The policy that followed has so far promoted a set of pro-cluster activities, among which training and human capability building, the development of a complex cluster involving input suppliers, logistic services and including new stages of the value chain such as breeding and feed production. A key policy component deals with environmental issues, the introduction of environmentally friendly best practices and compliance with international standards and health regulations. Technical expertise is provided to farmers to prepare them for exporting their products, respecting health standards and addressing challenges in packaging and shipping

requirements. An interesting component of the cluster support program is the exploration of the feasibility conditions and market opportunities for a future diversification strategy into the export of sea (salt-water) ornamental fishes, invertebrates and coral and live rocks to expand into a wider variety of aquatic products.

In the group of spontaneous clusters – i.e. several clusters in Trinidad and Tobago; the tourism clusters in Grenada and in Suriname; the creative one in Barbados and business services in Jamaica – cluster policies have aimed at creating a favorable business environment. In Grenada, the support provided to the tourism industry is articulated in a tax holiday for international firms, a national effort to promote a new image of the country as an ecotourism destination, a related marketing campaign to leverage the new brand internationally and an effort to moderate energy costs and airlift tariffs. In Suriname, the tourism cluster has so far benefited from recent physical infrastructure improvements and only very recently the Ministry of Trade and Industry and the Suriname Business Forum under the auspices of the Inter-American Development Bank have promoted a cluster development initiative.

In Trinidad and Tobago, several clusters – the food production, the energy, the tourism the maritime services and financial services clusters - receive support in information, communication and technology; in education and training; in infrastructure improvement (roads, utilities, air and sea ports); and, in the setting of a business favorable context (i.e. regulations about intellectual property rights).

Among the interventions for supporting cluster development, a key role is played by those initiatives aimed at building and strengthening the external connections of the clusters. A case in point is the coconut water cluster in Guyana in which Compete Caribbean is supporting the preparation of a market development plan and the exploration of the feasibility of entering the organic and fair trade market in order to diversify into a new value chain. In several clusters, the policies for development focus their attention on opening external channels for tapping into knowledge and for entering new markets, through well-known instruments such as technical visits, invitation of technical experts and participation in conventions, trade shows and business fairs.

(c) Clusters with Policy for Inception

Policy support has been key for the inception of the Guyanese clusters specialized in non-traditional agricultural products, aquaculture, and forestry and tourism. Compete Caribbean has supported the promotion of a complex program of trust building among

the local actors coordinated by a facilitator in the non-traditional agricultural products and in tourism clusters. An important component of the programs is training and capacity building for the local economic enterprises. In non-traditional agriculture, aquaculture and forestry, the cluster support also plays a key role in diffusing environmental best practices, in facilitating the adoption of international standards and facilitating clusters' access to external sources of knowledge, by organizing technological trips and visits abroad and by bringing technical experts into the clusters. A further element of inception policies concerns the access to markets through the development of marketing plans, the design and promotion of common brands, the collective participation in commercial tours and in international trade fairs.

6. A typology of clusters

6.1. The cluster analysis

An identification of groups of clusters has been carried out through cluster analysis – a multivariate statistical technique that serves to identify different groups of similar actors – along certain selected characteristics (Table 6-1) - geographical boundaries, cluster structure, collective efficiency, cluster innovation capacity, openness and stage of the life cycle.⁹ We have identified three groups of clusters, two of them (Group 1 and 3, named *Rising* and *Innovative Clusters*) are fairly similar, and they are both markedly different from the other group (Group 2, named *Sluggish Clusters*) (for a list of the clusters belonging to the different groups see Table A1 in Appendix 3). Table 6-2 and Figure 6-1 summarizes the main characteristics of the three groups.

The Rising Clusters (Group 1)

Rising Clusters include mainly emerging and growing clusters at the early stages of the cluster life cycle. Clusters of this group specialize in relatively new industries for the Caribbean region, such as the animation and the multimedia sectors, or exploit new market segments, as can be seen with eco-tourism in Grenada, Guyana and Suriname. Moreover, they tend to be very open to external actors, partially because they are populated by hub firms. In fact, this group includes all the hub-and-spoke clusters identified in this study. This organization structure facilitates the external connections of

⁹ We have used SPSS software for the analysis. We have not included the variable on policy, which is nevertheless associated to the obtained groups.

cluster firms, as it allows access to knowledge and markets. Two examples from Guyana are the coconut water cluster, which is organized around a processing firm from Trinidad and Tobago and the non-traditional agricultural products cluster led by an Israeli MNC.

In spite of being open and growing, these clusters do not display outstanding records both in terms of collective efficiency and of innovation capacity, which we classified as medium in our scale. Hence these clusters still deserve policy attention to further sustain cluster development, as discussed in the next section.

More specifically (see also Table 6-2), this group includes 13 Caribbean clusters located in several countries (4 in Guyana; 2 in Grenada; 2 in Jamaica; one, respectively, in Suriname and in Barbados; and, 3 inter-Caribbean). They specialize in tourism (5), natural resource based industries (4), creative industries (2), rum production (1) and maritime services (1). The geographical dimension of this group is quite varied. It is worth noticing that all the inter-Caribbean clusters belong to this dynamic group. The organization structure is also rather mixed with 8 Marshallian clusters and the entire hub-and-spoke clusters (5) included in this study.

The degree of collective efficiency can be classified on average as medium with low/medium external economies and medium/high joint action. The group has on average a low/medium innovation capacity and the highest value of openness indicator among the three groups.

Six of the clusters belonging to this group are in the emergence phase of the life cycle. Of the remaining 7 clusters, 6 are in the growth stage and only one in the sustainment phase.

There are 5 spontaneous clusters, three of them subsequently treated by cluster policy for development. In the remaining 8 clusters, three clusters have been set up from scratch through policy interventions and 5 are supported by policies for development.

Sluggish Clusters (Group 2)

Sluggish Clusters differ significantly from the other two groups. They are far less active and dynamic: they have on average a low to medium CE, very weak innovation capacity and a low degree of openness. These clusters take a Marshallian organization structure – i.e. they are populated mainly by local small enterprises, which interact with each other at either a sub-national, urban or national levels. In some cases, their firms target the local market only and this represents a clear constraint for further growth – see on this

the cases of the pottery and retail clusters in Trinidad and Tobago and that of the gold jewellery in Guyana. This group includes several spontaneous clusters, which have not received any policy treatment, while many of them would benefit from the presence of cluster policies, as elaborated in the next section.

More specifically (see Table 6-2), this group includes 8 clusters, located in Trinidad and Tobago (6) and Guyana (2), spanning different sectors (agriculture and forestry (3), tourism (2), gold jewelry (1), pottery (1) and retail services (1). In terms of geography, these clusters are sub-national (3), urban (1) and national (4). The organization structure is Marshallian plus one survival cluster.

The degree of CE is on average low/medium, both for EE and JA. Innovation capacity is low and the degree of openness very low. Moreover, these clusters are at different stages of the cluster life cycle: only one is in the emergence phase, 3 are respectively in the growth and sustainment phases, while one cluster is declining.

There are three spontaneous clusters with no policy interventions and in the remaining clusters policy has played a role for inception (1), for development (3) and for both (1).

Innovative Clusters (Group 3)

Innovative Clusters share some similarities with the group of *Rising Clusters* (i.e. high collective efficiency and openness), but the former are more innovative than the latter. Marshallian clusters displaying high collective efficiency and innovation capacity compose this group. Their sectors of specialization include some of the traditional industries in the region, such as the oil and the business, financial and maritime services, as well as the very dynamic aquaculture clusters in Guyana and Belize. This group appears to include the most successful clusters of the region, most of which have participated in cluster policies, as discussed later.

Table 6-2 shows that Innovative Clusters include a total of 11 clusters, which are located in Trinidad and Tobago (7), Jamaica (2), Guyana (1) and Belize (1). The clusters in the group are mainly national (8) with only one local and two urban clusters. All clusters are Marshallian. The group has a high degree of CE: EE are significantly higher than in the other two groups, and JA is also high. Innovation capacity is also higher than in the other groups, while the degree of openness is significantly higher to the one found in the group of *Sluggish Clusters* but not different from the group of *Rising Clusters*. This group includes both growing (9 clusters) and mature clusters (2 clusters in the sustainment

phase). For the vast majority of these clusters, policies have been important both for creating and further sustaining the development of their operations.

To conclude, *Rising* and *Innovative Clusters* include the most dynamic, active, open and collaborative types of clusters in the Caribbean region – with some differences existing in terms of their innovation capacity, cluster life cycle and organization structure. In contrast *Sluggish Clusters* represent the most passive and backward clusters in the region.

6.2. The main characteristics of Rising, Innovative and Sluggish Clusters and the appropriate policies

Clusters represent an opportunity to overcome some of the structural weaknesses suffered by Caribbean economies, namely the narrow scope for building economies of scale due to the small size of their domestic markets, poor regional linkages, difficulty accessing external knowledge and the low international competitiveness of their industries. Our analysis of clusters in the Caribbean suggests that specific cluster policies are likely to help these countries to overcome their barriers to growth. To be effective these policies need to consider that a certain degree of heterogeneity exists among clusters, and policies should therefore be tailored to the needs of different clusters. To this end, our analysis identifies three groups of clusters. Two are rather dynamic – the *Rising* and *Innovative Clusters*, while one group is composed by very passive and backward firms (*Sluggish Cluster*).

The Rising Clusters and the *Innovative Clusters*, share some common key features. First, they are open to foreign markets and maintain external channels (i.e. via MNCs or GVCs) through which they can tap into knowledge and technologies. Second, these clusters' firms can take advantage of strong collective efficiencies achieved thanks to features which include the local availability of a specialized labor market or the presence of collective projects for sharing transportation costs, adopting international standards, introducing environmental best practices or jointly selling their products in the international markets. In spite of these similarities, *Innovative Clusters* display a much higher innovative capacity as compared to *Rising Clusters*, which tend to be younger and therefore have accumulated lower technological capabilities.

As compared to the previous two, *Sluggish Clusters* are rather closed systems, often lacking connections to external channels and access to international markets. Many of them show a low degree of collective efficiency and poor innovative capacity.

We envisage that policy design should consider these differences and we therefore propose diversified recommendations for the three groups of clusters identified here.

For *Rising Clusters* policies should focus on: a) fostering innovation, which is a weak area for this kind of clusters; b) helping the transition of emerging clusters to a growth phase; c) supporting the consolidation of leading actors.

Fostering innovation. Innovation activities could be stimulated at firms' individual level (e.g. through competitive bidding schemes funding the most promising innovative projects, funding technological visits abroad, technical consultancies or other technology-intensive activities). Innovation could also be stimulated via collective action, that is, by promoting collaborative projects such as joint design or other innovative activities, including the acquisition of foreign technologies and/or knowledge. It would really depend on the nature of the cluster to discern whether individual grants (or funding) is more suitable than funding collective projects. Certainly, clusters in this group have very high joint action records, which means that collective projects may be rather successful, as they may be supported within an already favorable social fabric.

Helping the transition of emerging clusters to a growth phase. New clusters may face a number of challenges connected to the survival of start ups, their consolidation in the market as well as the achievement of economies of scale. It might therefore be important to support such a transition phase. This can be achieved, for instance, through the creation of incubators, providing adequate training of specialized human capital, easing the access to credit for innovative companies or facilitating the access of young firms to public procurement.

Supporting the consolidation of leading companies. Firms in this kind of cluster may need support to consolidate their leadership, as well as solve specific skill gaps in their transition from growth to maturity. Since leading actors are very important for the competitiveness of Caribbean clusters, for their access to external knowledge (i.e. they often are technological gatekeepers) and to foreign markets, specific policies designed to support these kind of actors may generate indirect effects on the whole cluster. Hence, we encourage policies addressing the problems, constraints, failures etc. of these actors.

Innovative clusters are the most successful in the region. In these clusters, policies should very selectively promote promising projects. Because these clusters are already rather dynamic, they should be sustained by targeting projects that are like to further push these clusters to the frontier of knowledge or to allow them to serve highly

demanding markets, or market niches, etc. Hence, these clusters should not be sustained at large (not least because they are already successful), but their best ideas or initiatives should be assessed by funding bodies to further promote skills and to achieve very ambitious targets. In these clusters, competition for funding should be very tough, with only a few exceptional projects being funded while the funding per winning project should be generous.

Finally, in *Sluggish Clusters* priorities should be: a) strengthening local joint action; b) enhancing openness for the access to valuable resources like knowledge and technologies; c) building up innovative capabilities.

Strengthening local joint action. Joint action can be strengthened through the setting up of activities/initiatives to which different actors might have an interest in participating, for instance by setting up workshops discussing the future challenges of the cluster, strategies they could enact to improve their situation, market opportunities and the identification of achievable goals. These initiatives might also involve trust-building activities.

Building up innovative capabilities. This is certainly the most difficult task for the accumulation of capabilities takes a long time and involves investments with uncertain returns. However, activities aimed at improving the skills of local workforce, improving design capabilities and creativity in given industries (where it is possible) or developing/improving products and processes are important for these firms.

Enhancing openness. Increased openness could facilitate access to valuable resources like innovation and technologies. Activities could include participation at fairs, technological visits and arranging for visits from foreign actors, such as consultants, who can introduce new knowledge. These clusters would also benefit from their firms' involvement in GVCs – finding a foreign or national large buyer or in some cases even insertion in 'fair trade' or ethical value chains could be an interesting option. To achieve this, it is important to develop programs that help local firms meet the quality standards and certification requirements that are needed to be part of GVCs and to help them identifying new market opportunities and new market segments.

It is however possible that these policies will achieve very little, because the firms in *Sluggish Clusters* may be poorly receptive of any kind of support. However, it is also true that these policies may contribute positively to the survival of micro-small entrepreneurs,

which in certain contexts has a positive social impact in the cluster and in the nearby area (e.g. more jobs or training opportunities).

As it is true for policy in general, a systematic monitoring and evaluation of whether measures targeted at clusters deliver the expected results in terms of enhanced local inter-firm coordination, networking with extra-cluster actors and economic, social and environmental performance is a must and should become part of standard practice to foster necessary and continuous processes of experimentation and policy learning.

To this end, an evaluation plan should outline upfront, during the policy preparation stage, indicators to monitor and evaluate progress over the different implementation phases and an evaluation specialist should always be part of the team responsible for policy measures (Giuliani et al, 2013). Moreover, in the launching of a policy, clear benchmarks and criteria for success and failure should be given to applicants and beneficiaries. Ideally cluster policy evaluation involves different qualitative (e.g., case study based) and quantitative methods, such as social network analysis and non-experimental techniques involving propensity score matching, difference-in-differences, instrumental variables and regression discontinuity design) and should therefore be suited to test the causal relationship between the policy measure and the performance of beneficiary firms.

To conclude, cluster policies are an interesting laboratory for local level diffusion of new forms of private-private, public-private, and public-public collaborations that could not have happened spontaneously (Pietrobelli et al, 2013). The emerging collaborative governance structures have the potential to become a platform on which more sophisticated collective actions can occur. Participatory strategic planning at the cluster level is a very useful tool to identify missing public inputs and create consensus around interventions associated with clusters.

7. Concluding remarks on the future prospects for clusters in the Caribbean

The analysis of 32 clusters across several countries and industries in the Caribbean allows some important and empirically robust observations: 1) cluster activity is very intense in the region; 2) the Caribbean clusters are very diverse on several key dimensions, as clearly shown with the identification of three groups – *Rising*, *Innovative*

and *Sluggish* Clusters – whose varied characteristics have been illustrated in details in the previous section; 3) supporting policies should be differentiated to address and reinforce different strengths and weaknesses in clusters; 4) in Caribbean clusters, there are already a variety of supporting interventions implemented, some of which do represent good practice examples.

Grounded on this solid empirical basis, some informed speculations can be drawn about the future prospects of growth in clusters and about if and how they can be expected to impact on the future economic development in the Caribbean region.

The study shows that new promising industries are flourishing thanks to a combination of private entrepreneurial spirits and good public policies. Clusters in creative industries, in business services, in non-traditional agro products and in aquaculture as well as some clusters in tourism addressing new segments of the market are dynamic and have good potentiality for future growth. These dynamic clusters should play a key role in signalling to the rest of the economy that diversification, entrepreneurship and innovation are possible in the Caribbean region when the private and the public sector can work well together.

Quite importantly, new skilled jobs could be expected in these dynamic clusters and this can help to address brain drain, one of the most painful problems in the Caribbean.

Besides, some of these clusters also show that external connections, through multinationals or within global value chains, are key to export, to access knowledge and acquire capabilities needed for being competitive in the international markets.

One of the biggest constraints to growth in the Caribbean region is the small size of the countries and the lack of economies of scale. In clusters, external economies and joint actions do represent opportunities to address such limitations. The study provides many interesting examples such as the coordination of lodges in Guyana or the promotion of the successful adoption of environmental standards in the shrimp production in Belize. Addressing these constraints at the cluster level is important and, as shown by the cases presented in this document, could be successful; nevertheless there is a lot of potentiality to promote the development of external economies and cooperation inter-clusters, inter-industries and inter-countries. Therefore, there is an urgent need for an integrated and coordinated approach to clusters, aimed at strengthening the complementarities among industries such as the creative sectors, tourism, agro-products and aquaculture. Besides, countries in the region need to collaborate in building up a regional innovation system in

which some institutions, such as the metrology institute or the standardization bodies can assist companies at a regional level. Knowledge flows among companies and research bodies at the regional scale should also be incentivized, for instance by funding competitive tenders for research programs involving companies and research institutions from different countries in the region.

Existing dynamic clusters do represent very good examples of what can be achieved at the collective level, thanks to external economies and joint actions, now the challenge is to extend the approach at an intra-Caribbean scale, with an open eye for key external connections.

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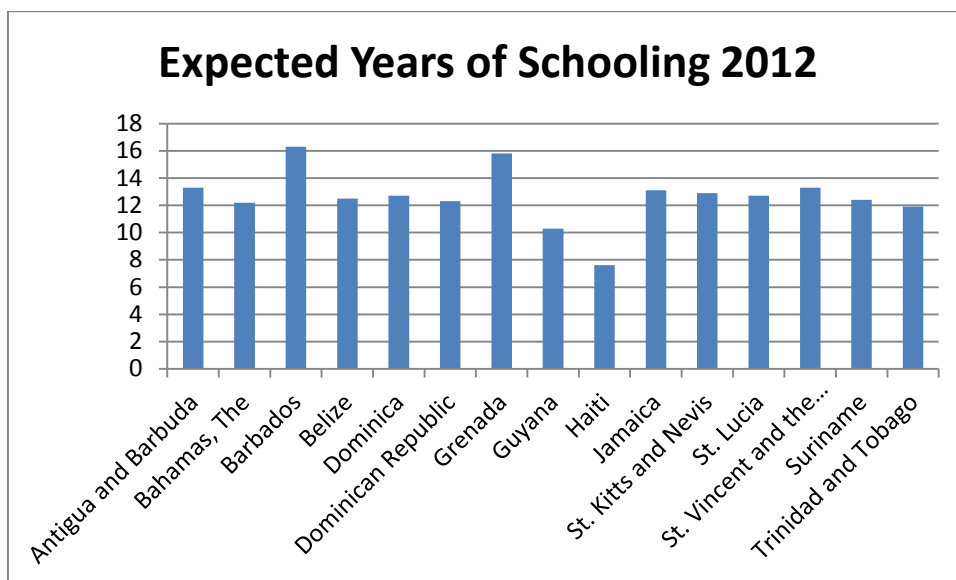
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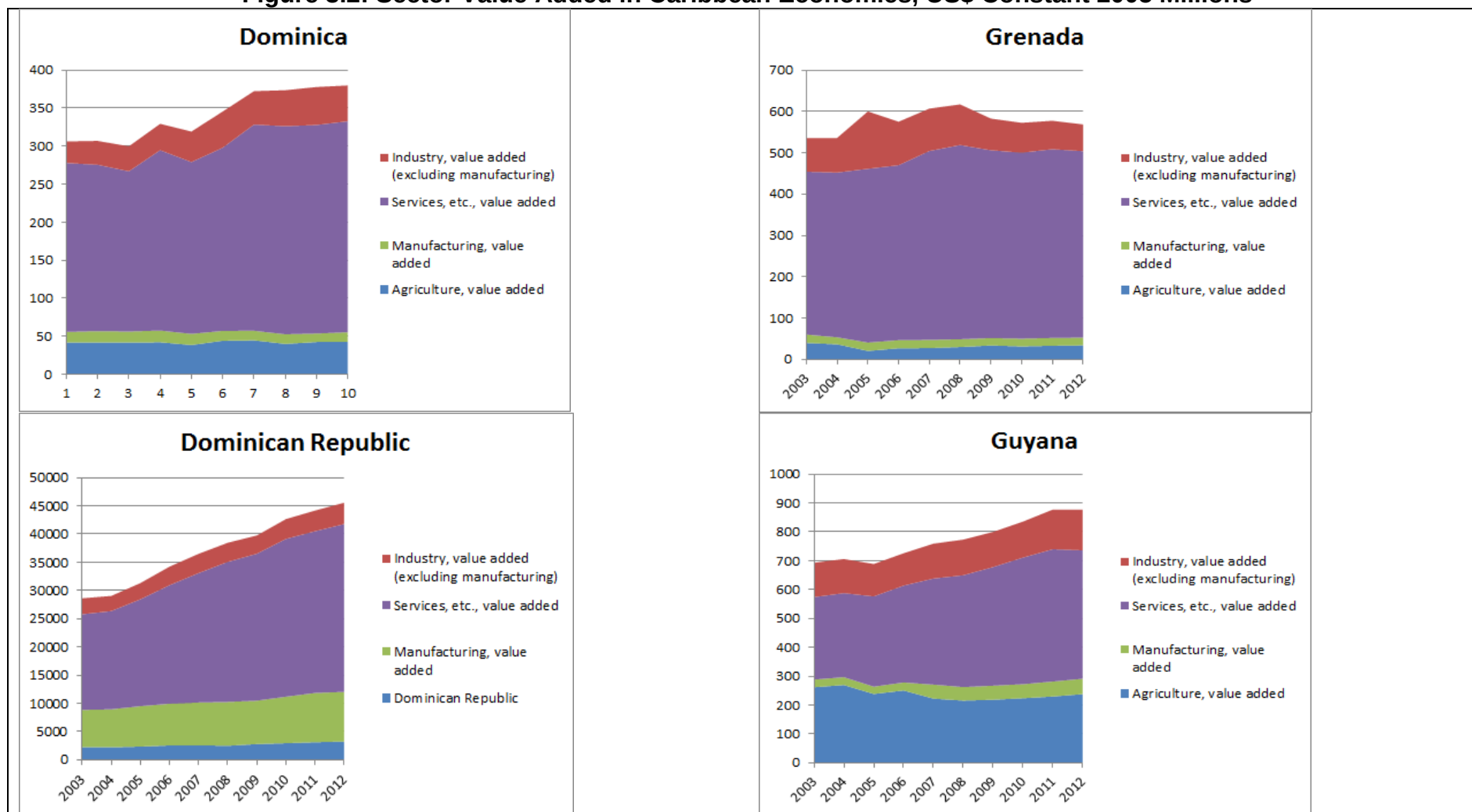
Figures and Tables

Figure 3.1: Expected Years of Schooling - 2012

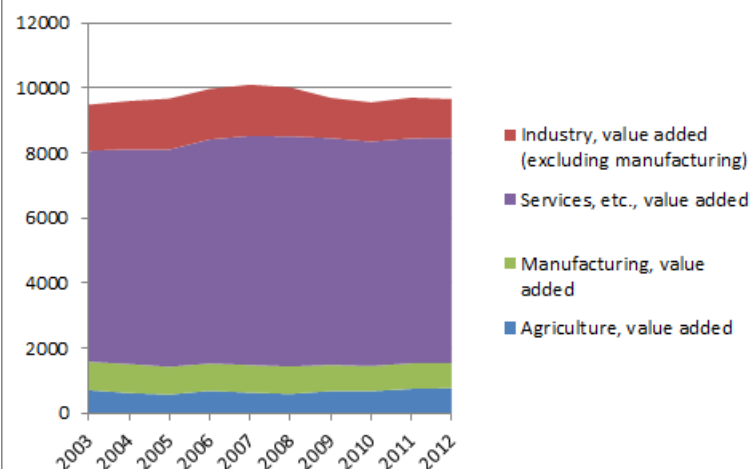


Source: UNDP, 2014

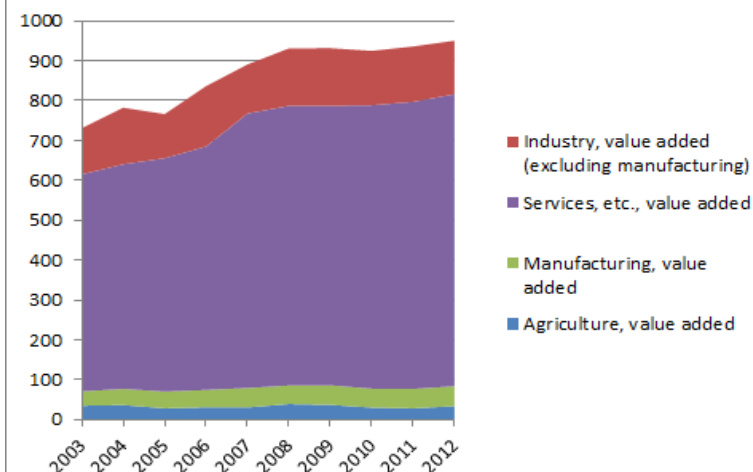
Figure 3.2: Sector Value Added in Caribbean Economies, US\$ Constant 2005 Millions



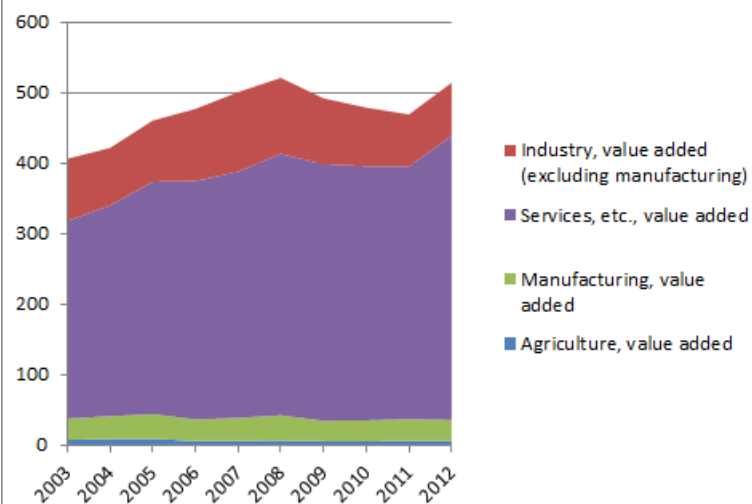
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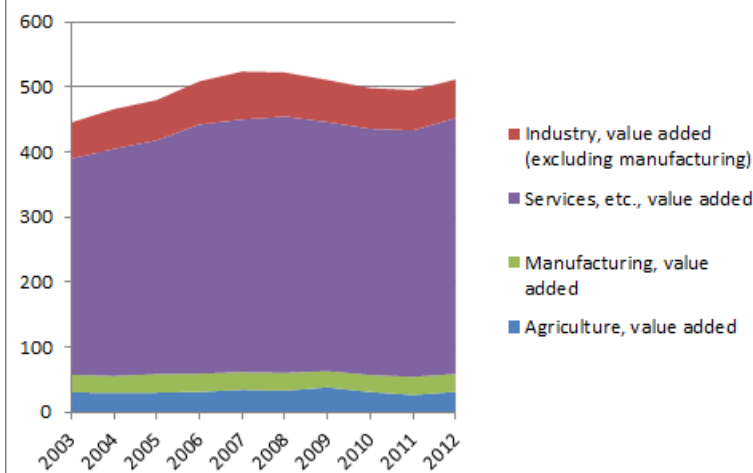
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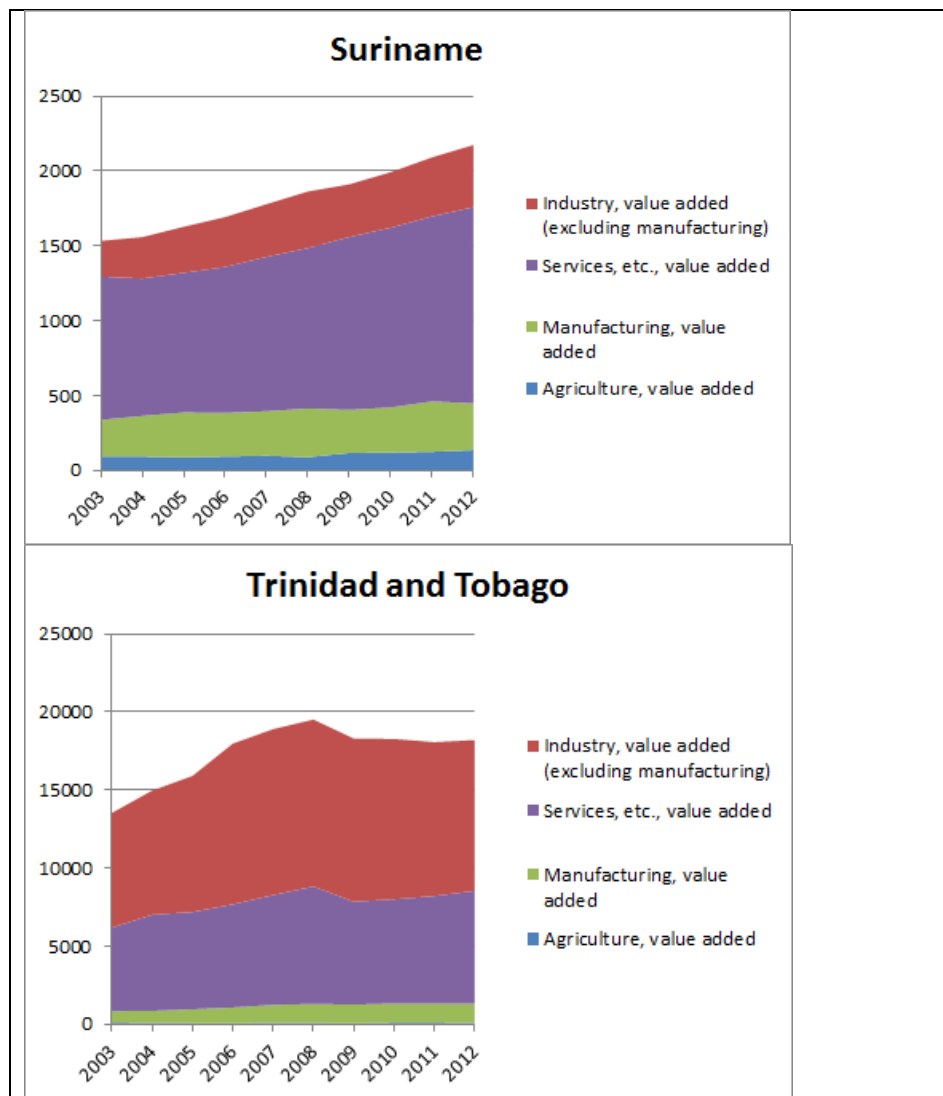


St Kitts and Nevis



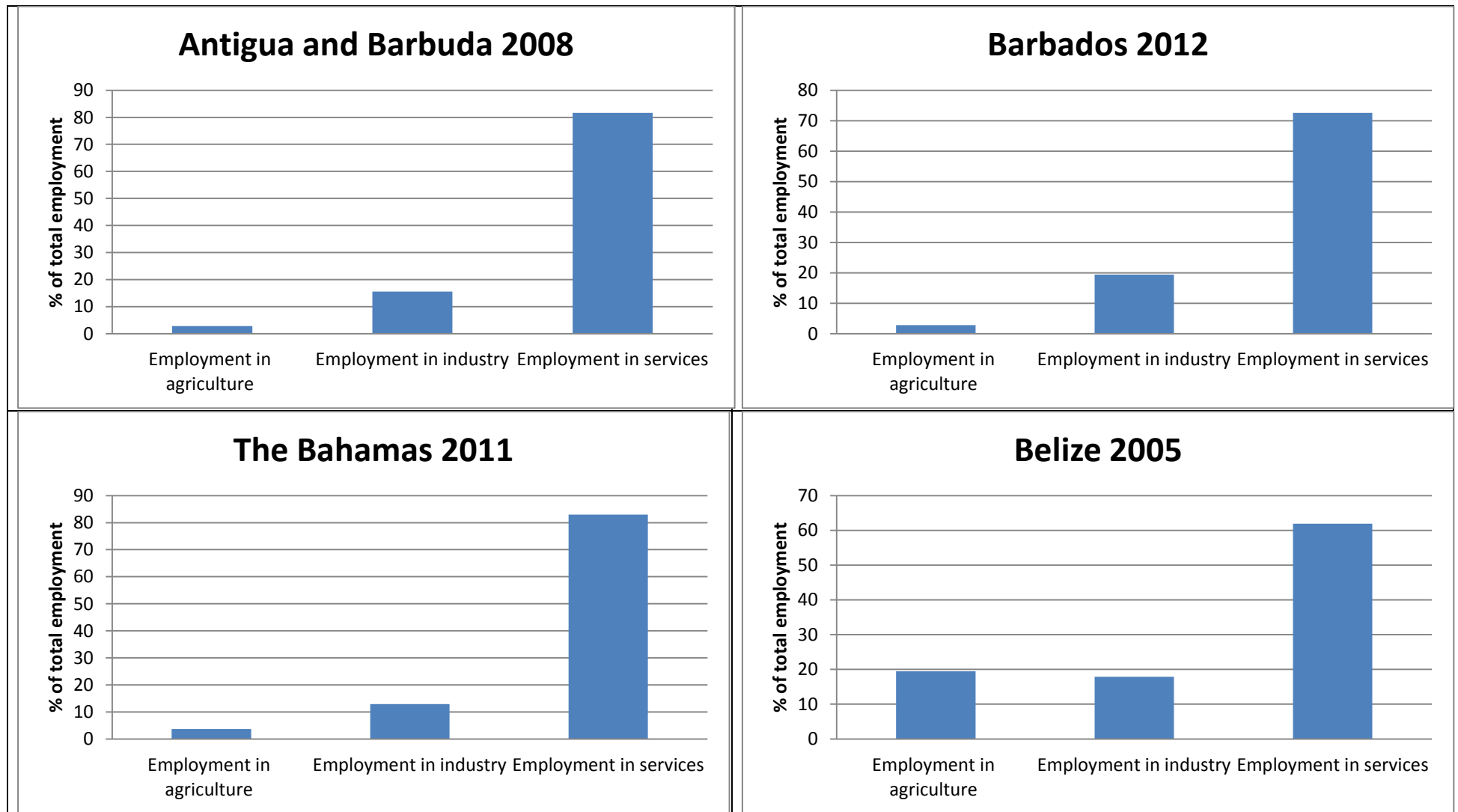
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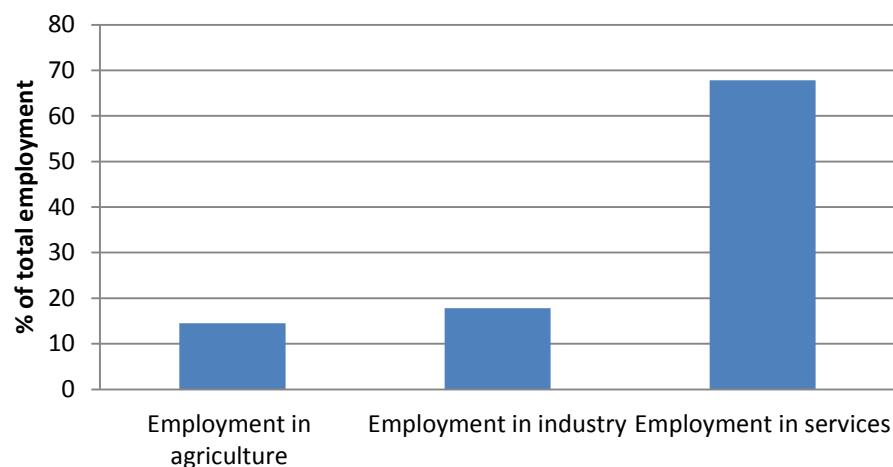


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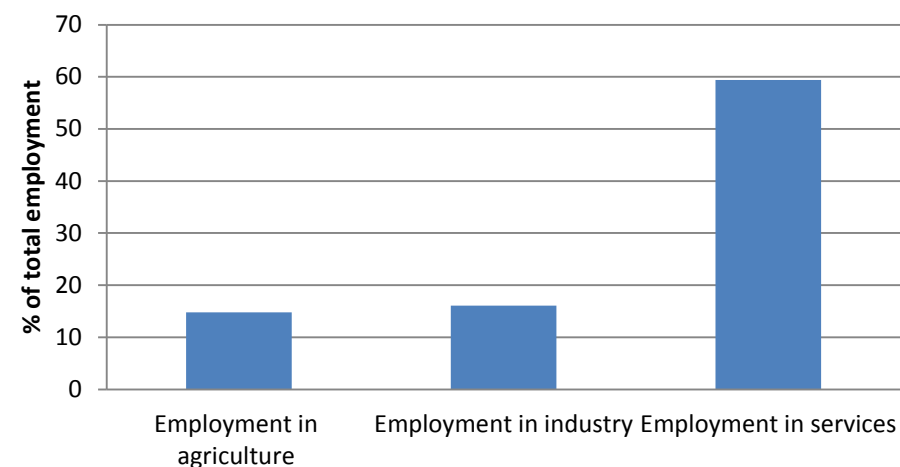
Figure 3.3 - Breakdown of National Employment



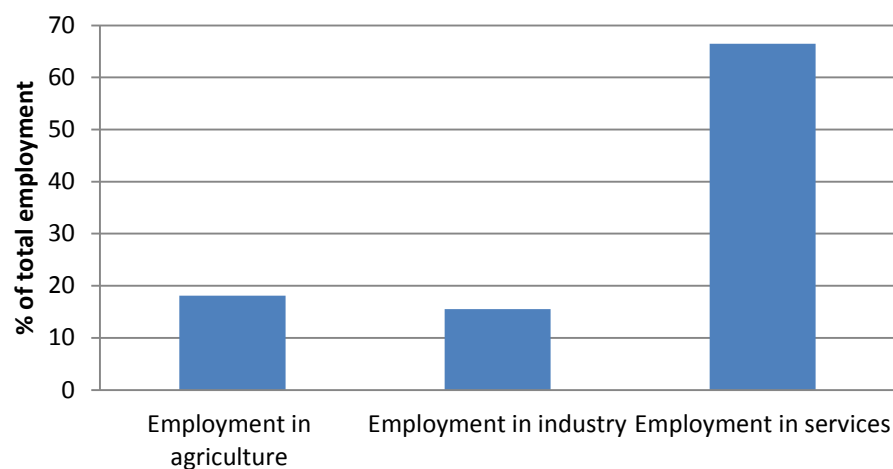
Dominican Republic 2011



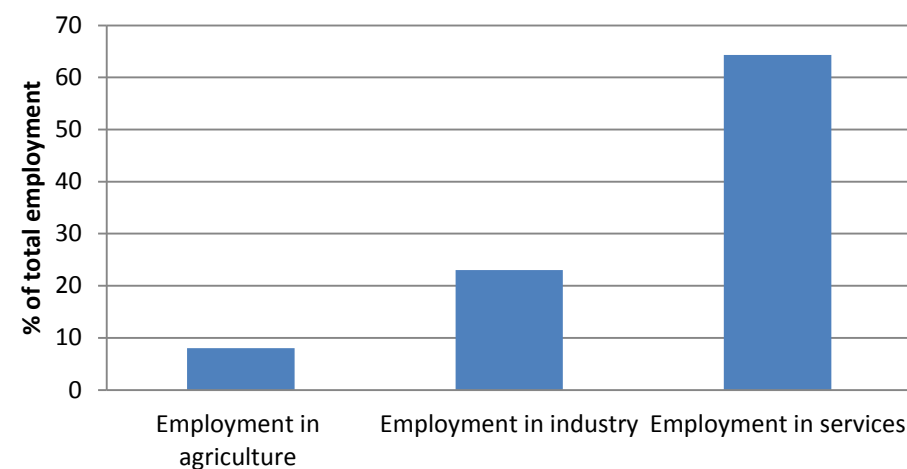
St. Lucia 2004

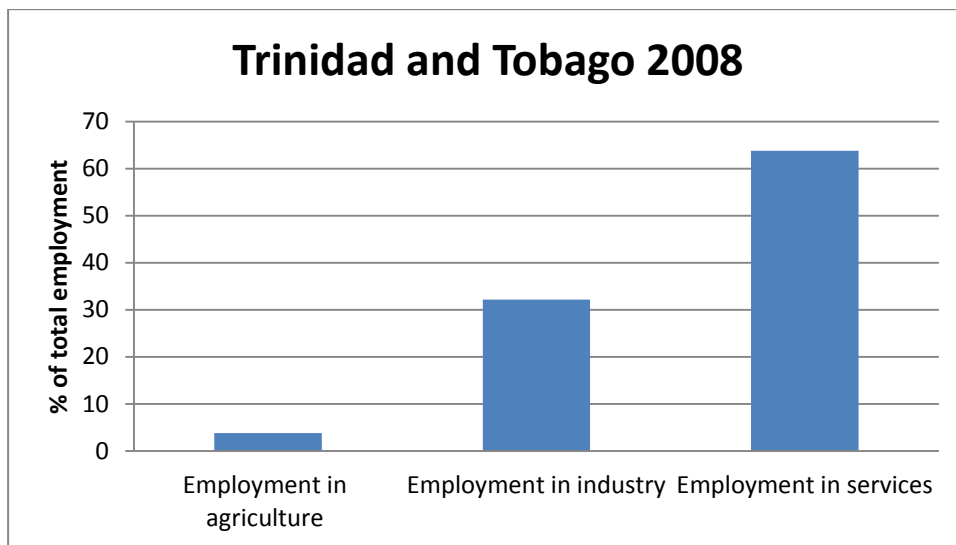


Jamaica 2012



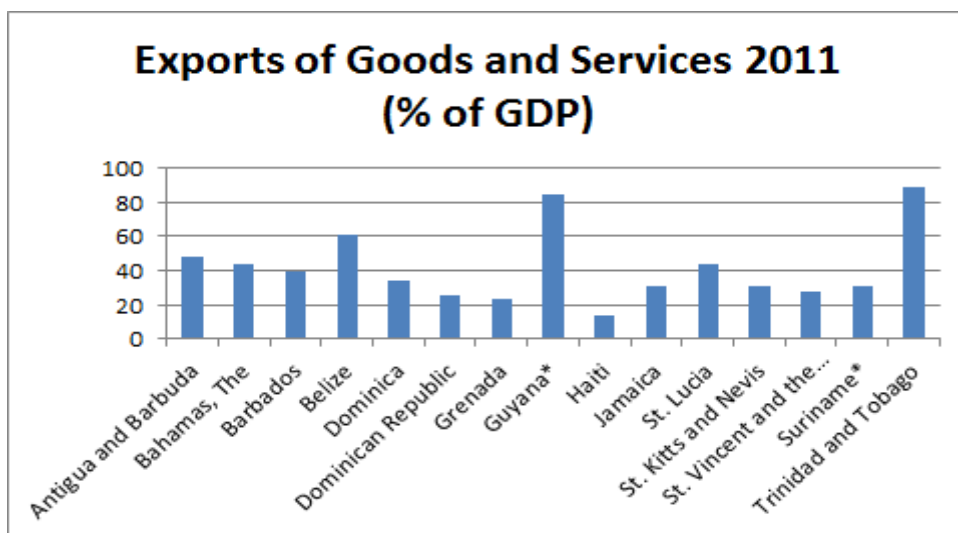
Suriname 2004





Source: World Bank World Development Indicators 2014

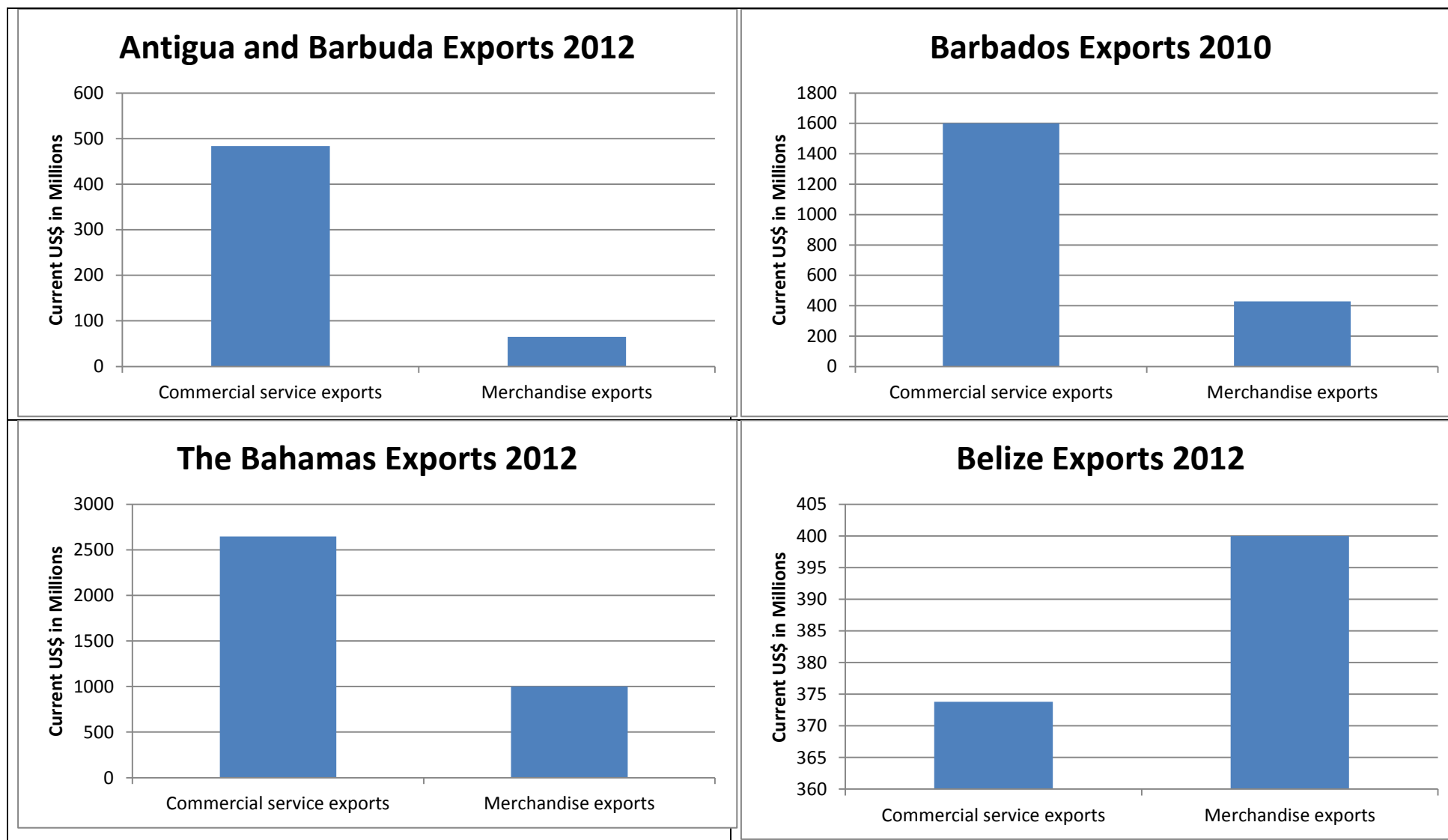
Figure 3.4 - Exports of Goods and Services 2011



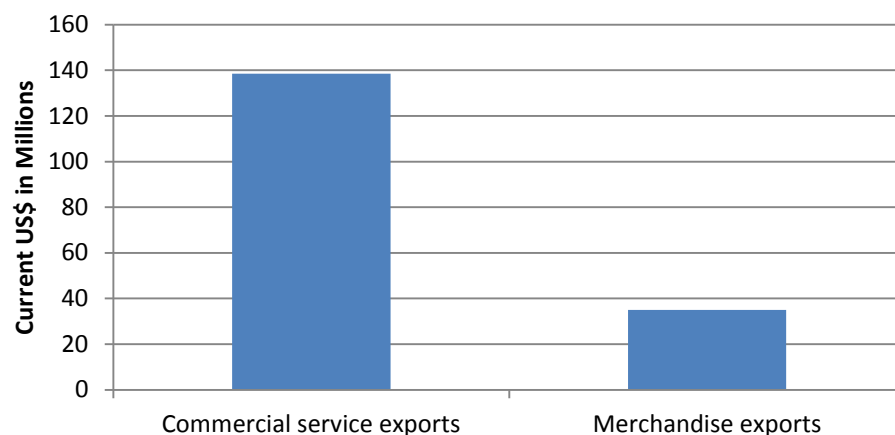
*Grenada and Suriname figures are for 2005

Source: World Bank World Development Indicators 2014

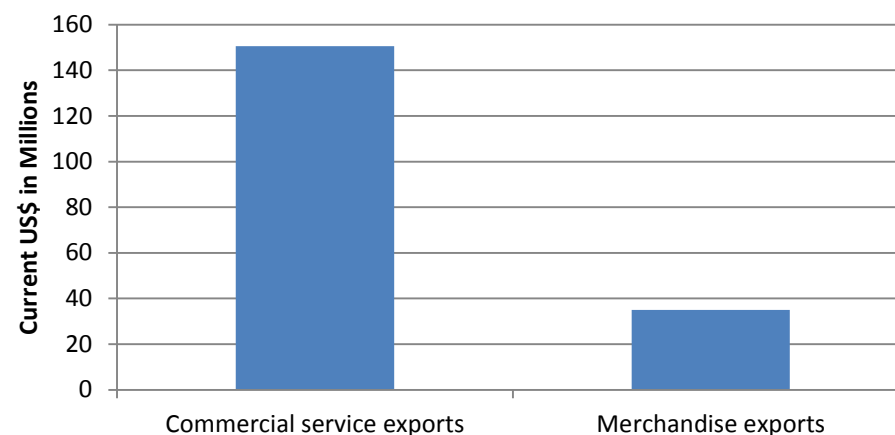
Figure 3.5 - Balance between commercial service and merchandise exports



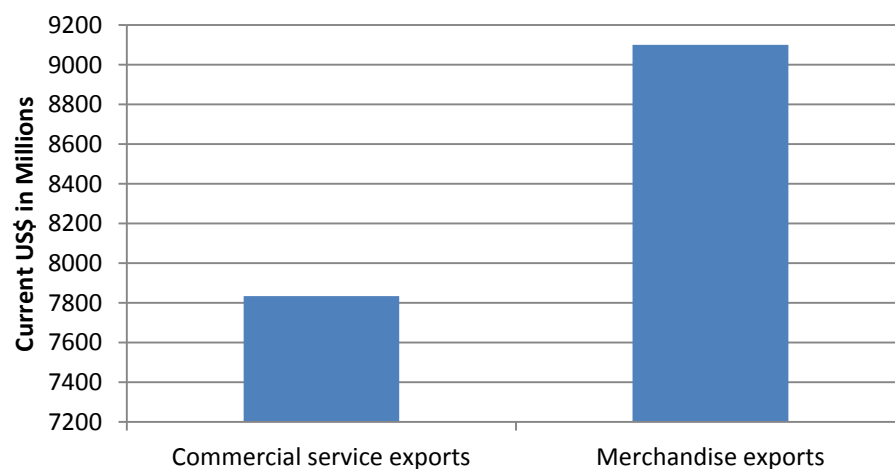
Dominica Exports 2012



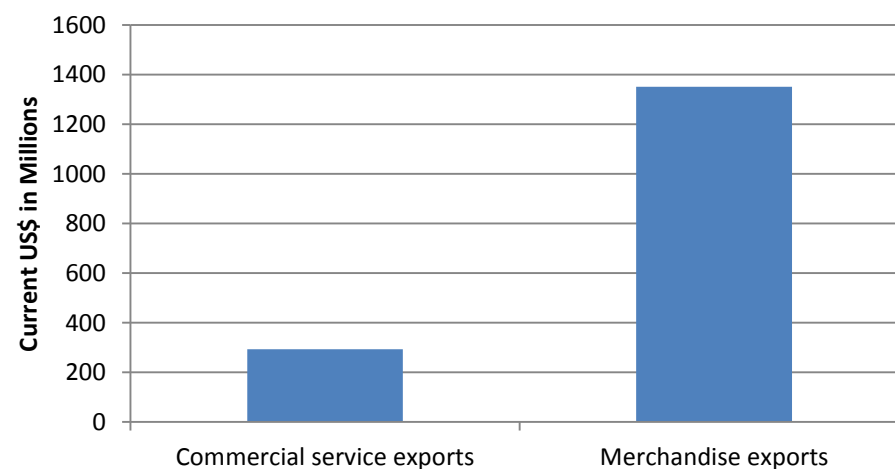
Grenada Exports 2012



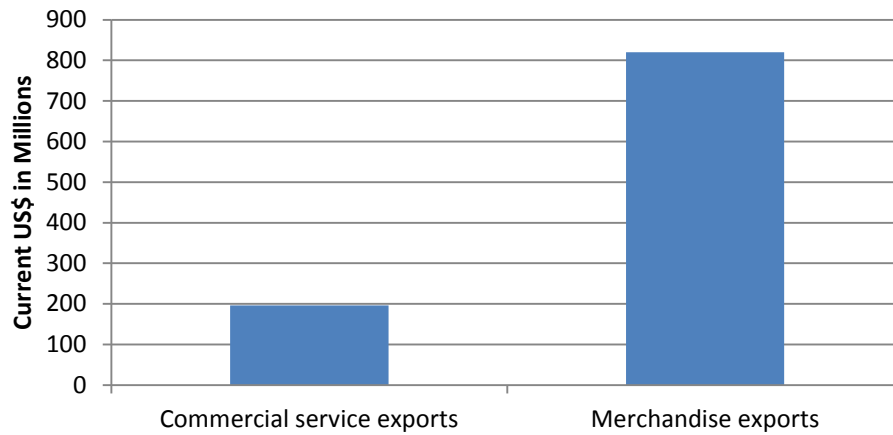
Dominican Republic Exports 2012



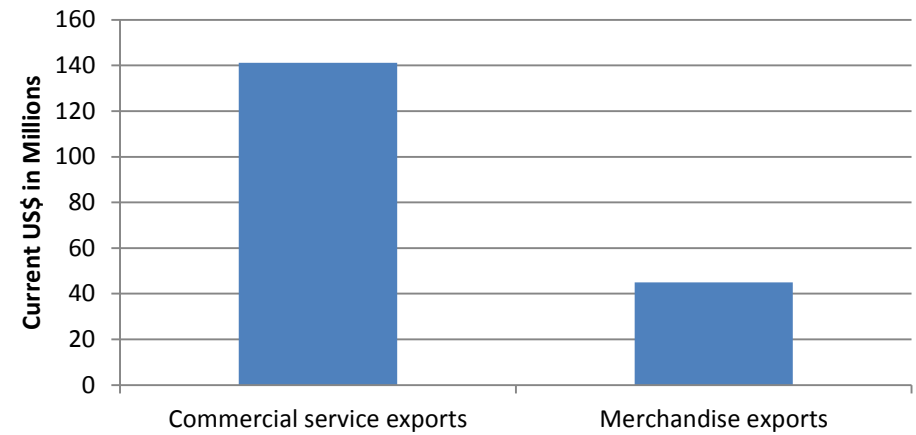
Guyana Exports 2012



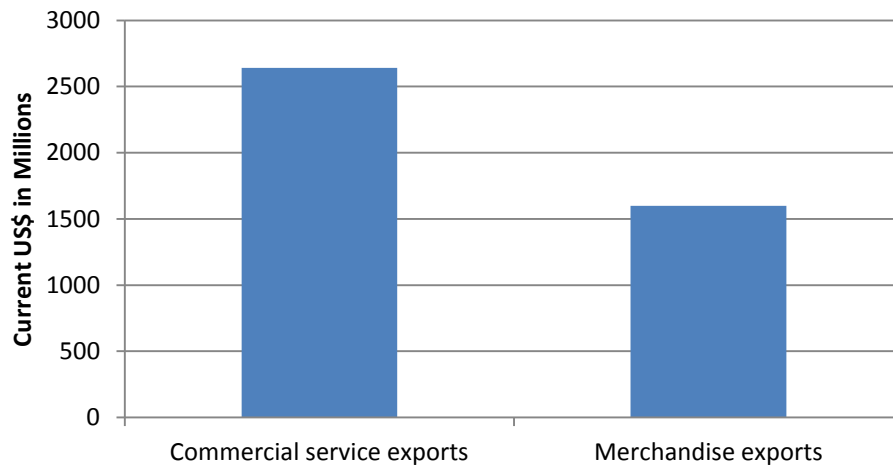
Haiti Exports 2012



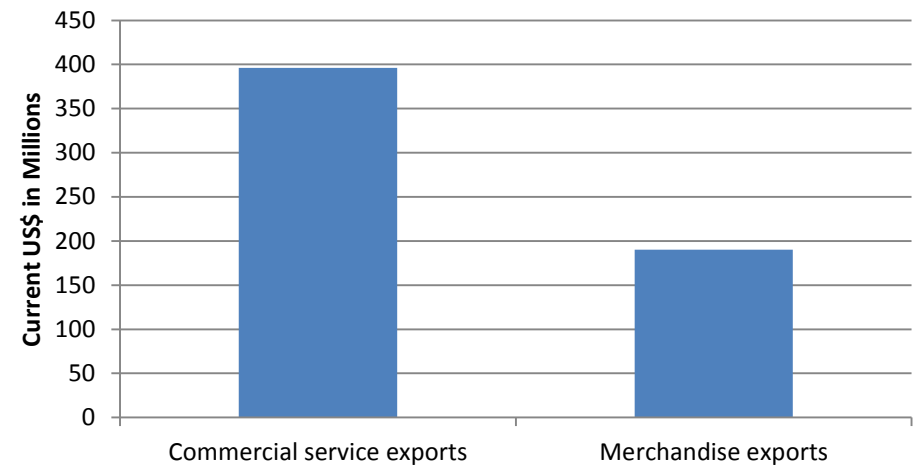
St Kitts and Nevis Exports 2012



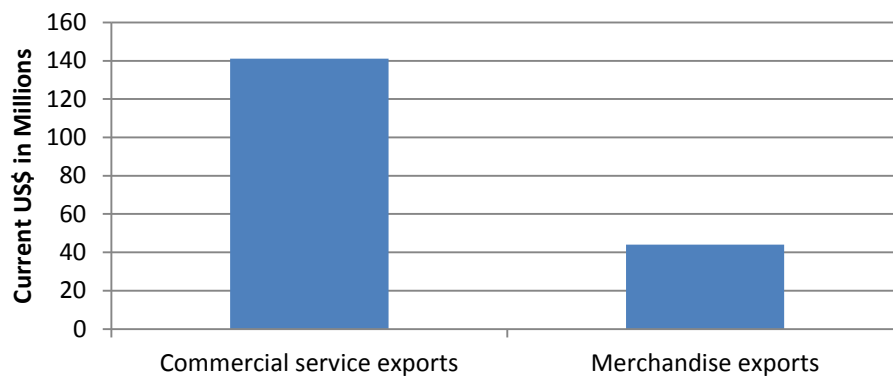
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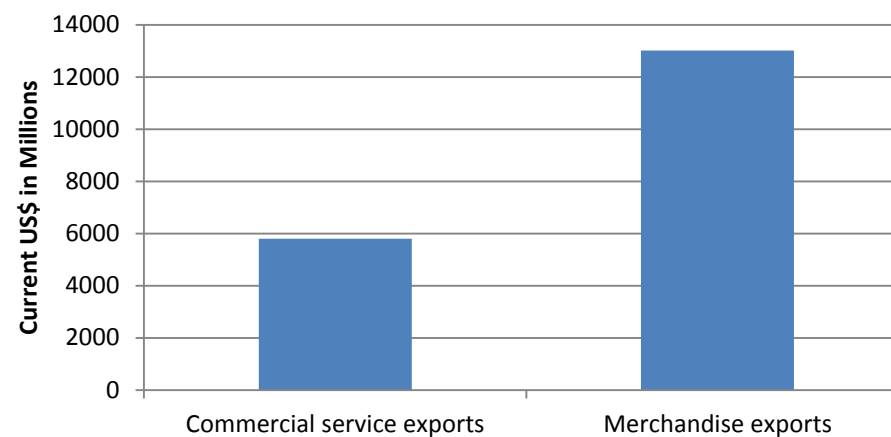
St Lucia Exports 2012



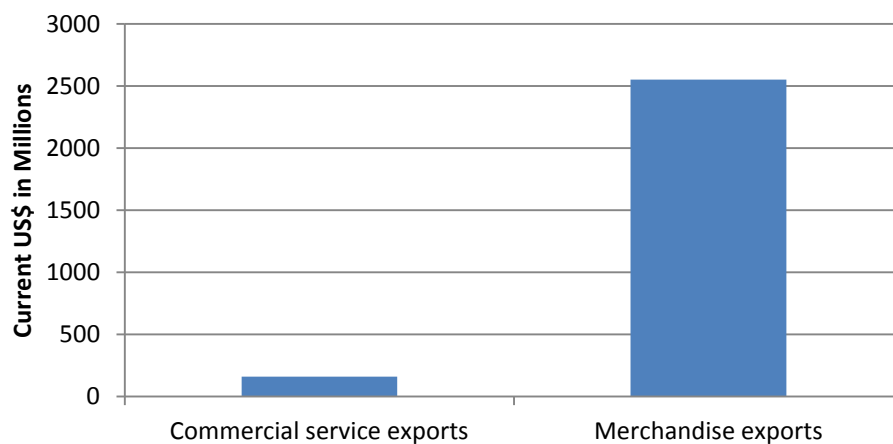
St Vincent and the Grenadines Exports 2012



Trinidad and Tobago Exports 2011



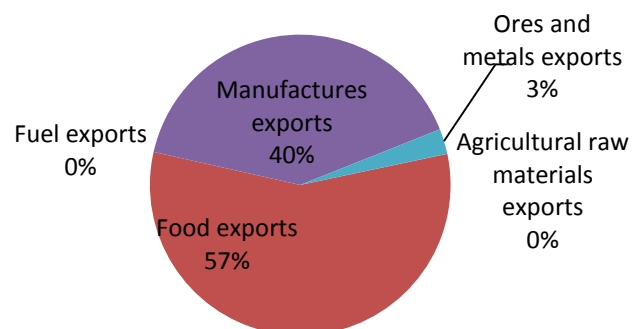
Suriname Exports 2012



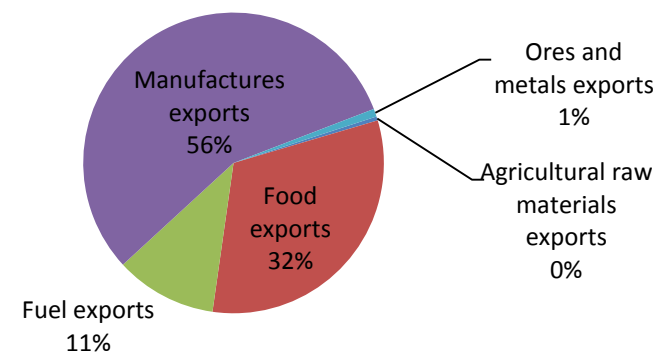
Source: World Bank World Development Indicators 2014

Figure 3.6 - Merchandise Exports

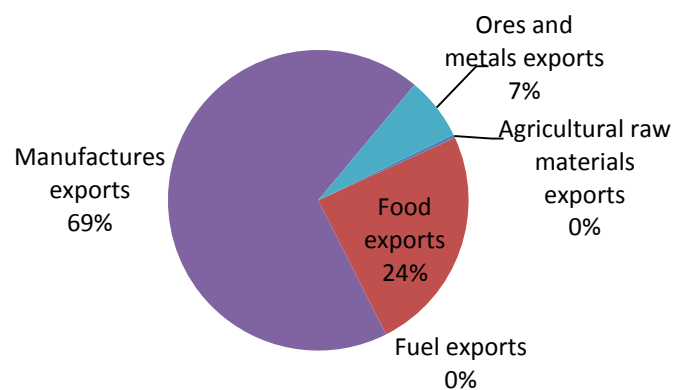
Antigua and Barbuda Merchandise Exports 2012



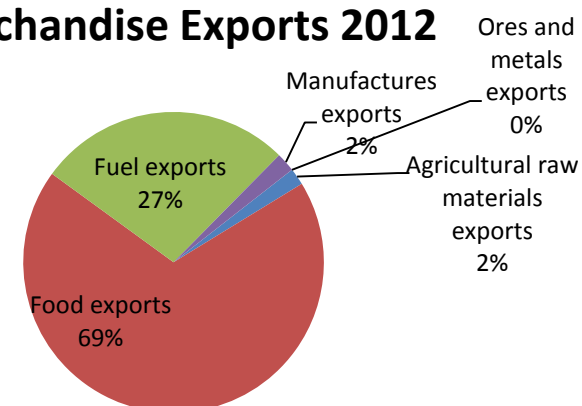
Barbados Merchandise Exports 2012



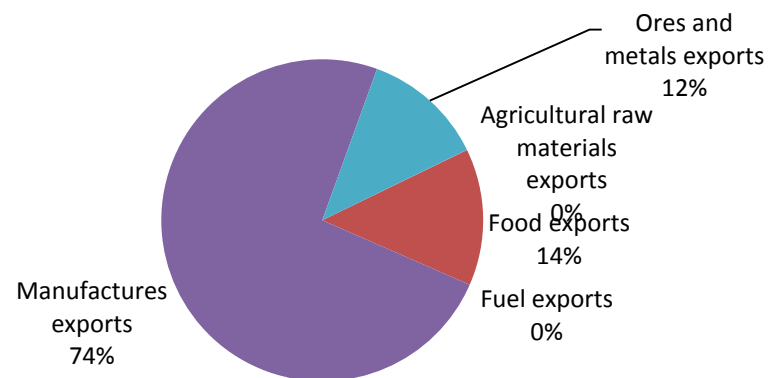
The Bahamas Merchandise Exports 2012



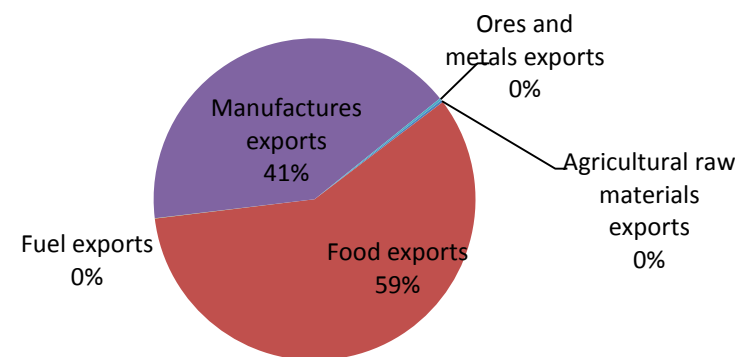
Belize Merchandise Exports 2012



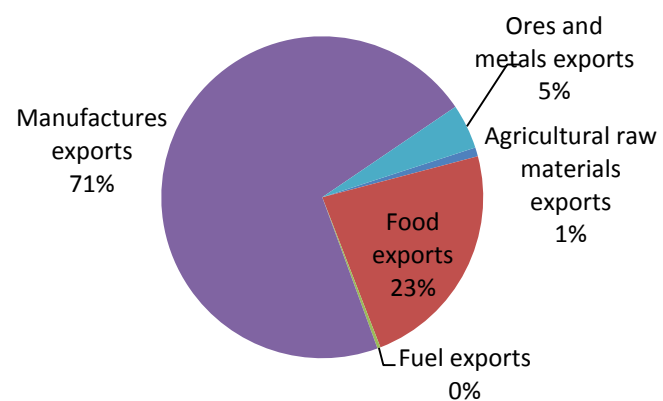
Dominica Merchandise Exports 2012



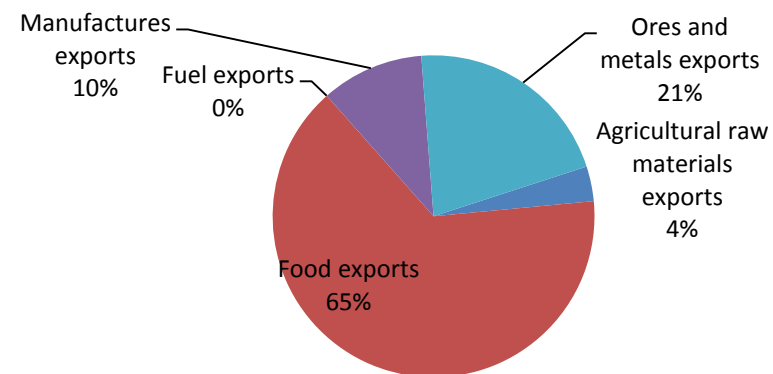
Grenada Merchandise Exports 2008



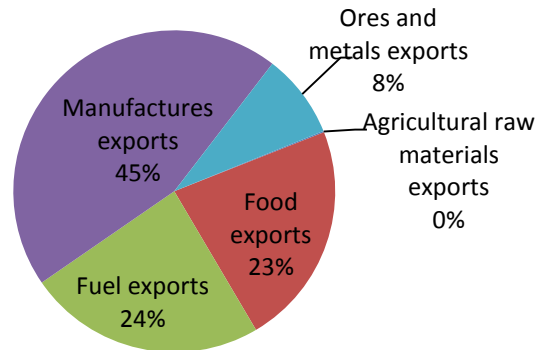
Dominican Republic Merchandise Exports 2012



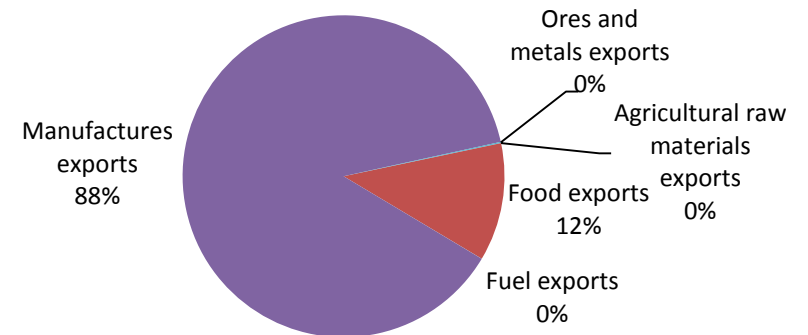
Guyana Merchandise Exports 2012



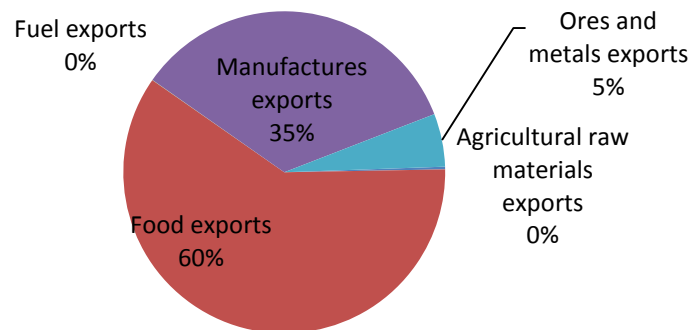
Jamaica Merchandise Exports 2012



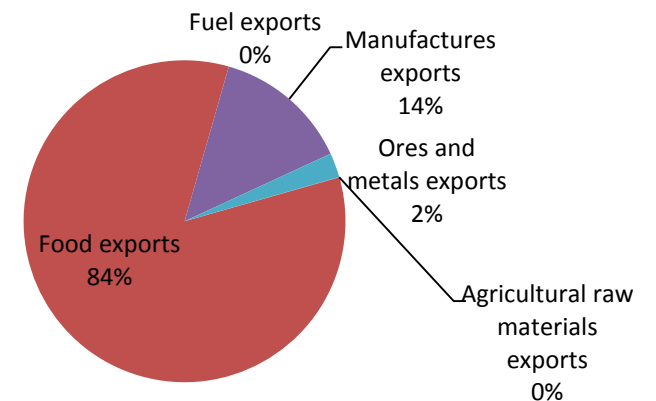
St. Kitts and Nevis Merchandise Exports 2011



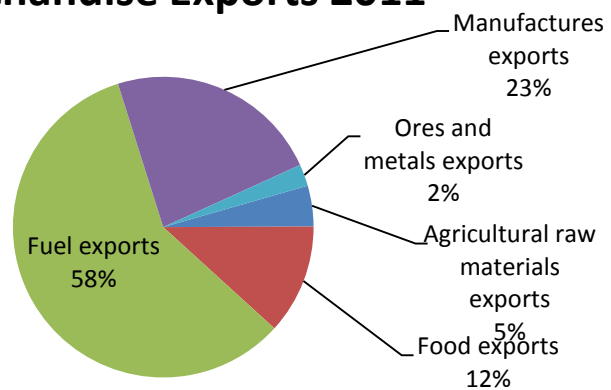
St. Lucia Merchandise Exports 2008



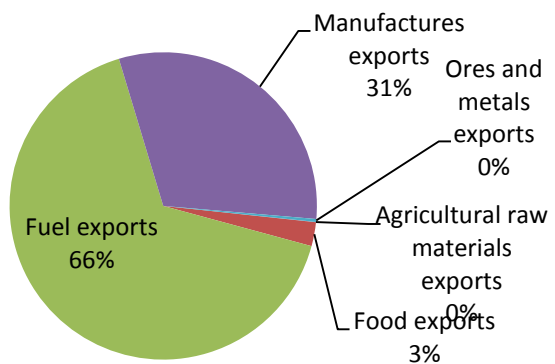
St. Vincent and the Grenadines Merchandise Exports 2012



Suriname Merchandise Exports 2011

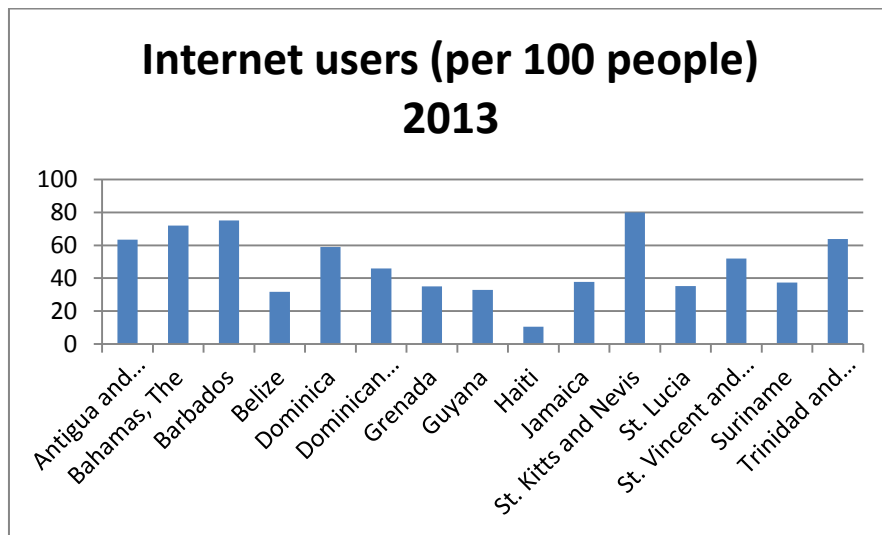


Trinidad and Tobago Merchandise Exports 2010



Source: World Bank World Development Indicators 2014

Figure 3.7 - Internet Users per 100 People 2013



Source: World Bank Data 2014

Figure 4.1 – The Six Dimensions for Cluster Classification

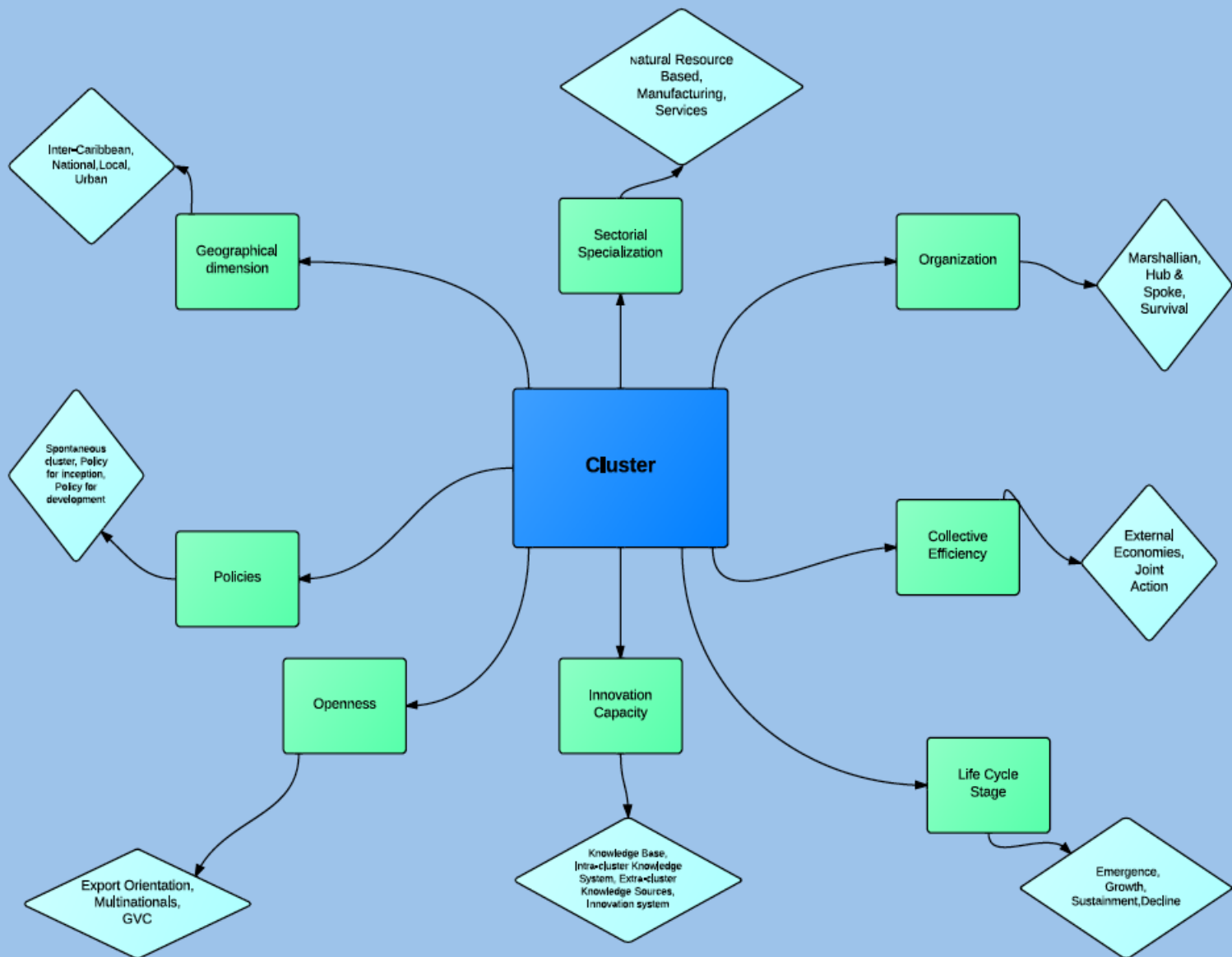


Figure 6.1 - The Cluster Typology

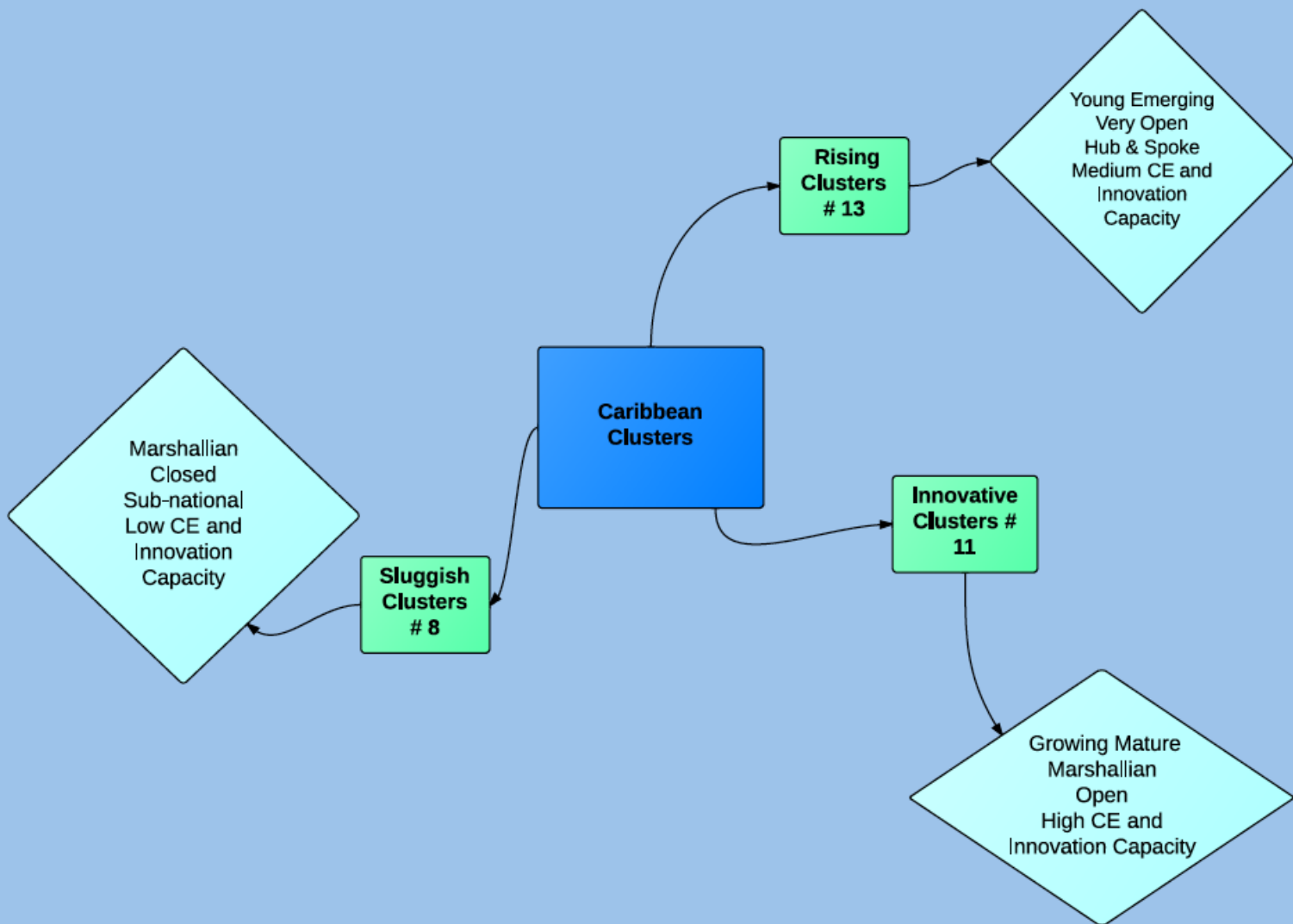


Table 4-1 – Measurement of cluster dimensions

Dimension	Measure	Synthetic indicator
Cluster structure		
• Sectoral specialization	Qualitative	
• Geographical dimension	Qualitative	
• Organization	Qualitative	
Collective efficiency	Low, Low/Medium, Medium, Medium/High, High	Average Value
• External economies		
• Joint Action		
Innovation Capacity	Low, Low/Medium, Medium, Medium/High, High	Average Value
• Knowledge base		
• Intra-cluster knowledge		
• Extra-cluster knowledge		
• Innovation System		
Openness		
Export orientation	Absent, Low, Growing, Medium, High	Closed, Closed-Opening, Semi-Open, Open
Multinationals	Yes, No	
Global Value Chains	Yes, No	
Stage of Life Cycle		
Size of clusters	# of actors involved	Emergence, Growth, Sustainment, Decline
System's characteristics	Degree of joint action (see CE)	
Existence of open networks and channels for accessing external knowledge	See Openness	
Policies		
Spontaneous cluster	Yes, No	
Inception policies	Yes, No	
Development policies	Yes, No	

Table 5-1 – Caribbean clusters: the main dimensions

Clusters	Geographical Dimension	Cluster Organization	Collective efficiency		Innovation Capacity	Openness	Stage of the Life Cycle	Cluster Policy
NATURAL RESOURCE BASED			EE	JA				
Agriculture								
• Guyana (Non-traditional agriculture)	N	H&S	M	M/H	M	O	G	I
• Grenada (Nutmeg)	N	M	L/M	M	L/M	S-O	G	S
• T&T (Agro products in Felicity)	L	M	M	M/H	L/M	C	G	I/D
• T&T (Agro products in Jerningham)	L	M	M	L/M	L/M	C	G	I
Agro-processing								
• Guyana (Coconut Water)	L & I-C	H&S	M	H	L/M	O	G	D
• T&T (Food Sustainability)	N	M	H	H	M	C	G	D
Forestry								
• Guyana (Forestry and wood products)	N	M	L/M	L	M	O	G	D
Aquaculture								
• Guyana (Aquaculture)	N	M	M	M/H	M/H	C/O	G	I/D
• Belize (Shrimp)	N	M	H	M/H	M	S-O	G	D
• Jamaica (Ornamental Fish)	U	H&S	M	M/H	M	S-O	E	S/D
Energy								
• T&T (Oil and gas prod. and services)	N	M	H	H	H	O	S	S/D
• T&T (Point Lisas Industrial Estate)	L	M	H	M/H	M/H	O	G	I/D
MANUFACTURING								
• Guyana (Gold Jewelry)	N	M	M	L	L/M	C	S	S
• Various countries (Rum)	I-C	M	L/M	H	M	O	S	D
SERVICES								
Tourism								
• Guyana (Fishing in North Rupunini)	L	M	L	H	L	S-O	G	I
• Guyana (Birding)	N	M	M	M	M	O	E	I
• T&T (Tourism in Carapichaima)	L	M	L/M	L	L/M	C/O	E	D
• T&T (Tourism)	N	M	M	L/M	L	S-O	S	D
• Jamaica (Treasure beach)	L	M	L/M	M/H	L	S-O	E	S/D
• Grenada (Geo-tourism)	N	M	L	M	M	O	G	D
• Suriname (Upper Suriname River Area)	L	M	M	M	L/M	S-O	E	S/D
Creative Industries								
• Various countries (Animation industry)	I-C	M	L/M	M	L/G	C/O	E	D
• Barbados (Multimedia)	N	H&S	M	M/H	M/G	O	E	S
• T&T (Music, film, Carnaval etc.)	N	M	H	M	H	O	G	D
• T&T (Pottery)	L	S	L	M	L	C	D	S
Other Services								
• T&T (Maritime services)	N	M	M	H	H	S-O	G	D
• T&T (Financial services)	U	M	H	M/H	H	O	S	D
• T&T (Business services)	U	M	H	L/M	H	S-O	G	S
• T&T (Retail)	U	M	M	M/H	L	C	S	S
• Jamaica (ICT/business services)	N	M	H	M/H	M/H	S-O	G	S/D
• Jamaica (Printing and Packaging)	N	M	M	M	M/H	S-O	G	S/D
• Various countries (Maritime services)	I-C	H&S	M	M	M	O	G	D

LEGENDA: Stage of life cycle: E = Emergence, G = G, S = Sustainment, D = Decline

Table 5-2 – Caribbean clusters: Collective Efficiency (L = L; M = M; H = H; GROWING = G)

CLUSTERS	EXTERNAL ECONOMIES				JOINT ACTION		
	Labour market	Inputs	Information	Market access	Vertical Back/For	Horizontal Bi-lateral	Multi-lateral
NATURAL RESOURCE BASED							
Agriculture							
• Guyana (Non-traditional agriculture)	M	M		M	H		M
• Grenada (Nutmeg)	M	L	L	M	L	H	M
• T&T (Agro products in Felicity)	L	M	H	H	M		H
• T&T (Agro products in Jerningham)	L	M	H	H	L		M
Agro-processing							
• Guyana (Coconut Water)	M	L		H	H	H	M
• T&T (Food Sustainability)	H	H	H	H	H		H
Forestry							
• Guyana (Forestry and wood products)	M	M	L	L		L	H
Aquaculture							
• Guyana (Aquaculture)	M	M	M	L	M		H
• Belize (Shrimp)	H	H	H	M	H	M	H
• Jamaica (Ornamental fish)	L/M	H	M	H	H	M	M
Energy							
• T&T (Oil and gas production and services)	H	H	H	H	H		H
• T&T (Point Lisas Industrial Estate)	H	H	H			M	H
MANUFACTURING							
• Guyana (Gold Jewelry)	L	M		M			L
• Various countries (Rum)	L	L	M	H	M/H	H	H
SERVICES							
Tourism							
• Guyana (Fishing in North Rupunini)	L	L	L	L	H	H	H
• Guyana (Birding)	M			M	M		M
• T&T (Tourism in Carapichaima)	L	L	M	M	L		L
• T&T (Tourism)	H	H	L	M	L	L	M
• Jamaica (Treasure beach)	L	L	M	M	M	H	H
• Grenada (Geo-tourism)	L	M	L	L	L	H	H
• Suriname (Upper Suriname River Area)	M	M	M	M	M	L	M/H
Creative Industries							
• Various countries (Animation industry)	L/M	L/M	L/M	M	M	M	M
• Barbados (Multimedia)	M	M	L/M	L/M	M/H		M/H
• T&T (Music, film, Carnaval etc.)	H	M	H	H	M	L/H	M
• T&T (Pottery)	L	L		M			M
Other Services							
• T&T (Maritime services)	H	L		H	H		H
• T&T (Financial services)	H	H		H	M		H
• T&T (Business services)	H	M	H		L		M
• T&T (Retail)	M	L	M	H	M	L/M	L/M
• Jamaica (ICT/business services)	H	H			H	M	H
• Jamaica (Printing and Packaging)	L/M	L	M	H	H		M
• Various countries (Maritime services)	L	L		H	L		M/H

Table 5-3 – Caribbean clusters: Innovation Capacity

CLUSTERS	Knowledge base of the cluster firms	Intra-cluster knowledge system	Extra-cluster knowledge sources	Innovation system	Innovation capacity
NATURAL RESOURCE BASED					
Agriculture					
• Guyana (Non-traditional agriculture)	M	M	H	M	M
• Grenada (Nutmeg)	M	M	L	L	L/M
• T&T T&T (Agro products in Felicity)	L	M	M	L	L/M
• T&T (Agro products in Jerningham)	L	M	M	L	L/M
Agro-processing					
• Guyana (Coconut Water)	L	L	M	M	L/M
• T&T (Food Sustainability)	M	M		H	M
Forestry					
• Guyana (Forestry and wood products)	M	M	M	H	M
Aquaculture					
• Guyana (Aquaculture)	M	M	H	H	M/H
• Belize (Shrimp)	M	M	M	M	M
• Jamaica (Ornamental Fish)	M	M	M	H	M
Energy					
• T&T (Oil and gas prod and services)	H	H	H	M	H
• T&T (Point Lisas Industrial Estate)	H	H	M	M	M/H
MANUFACTURING					
• Guyana (Gold Jewelry)	M	M	L	L	L/M
• Various countries (Rum)	M	L	M	M	M
SERVICES					
Tourism					
• Guyana (Fishing in North Rupunini)	L	L	M	L	L
• Guyana (Birding)	M	M	M	L	M
• T&T (Tourism in Carapichaima)			L	M	L/M
• T&T (Tourism)	L	L	M		L
• Jamaica (Treasure beach)	L	L	L	L	L
• Grenada (Geo-tourism)	L	L	H	H	M
• Suriname (Upper Suriname River Area)	M	M	L	L	L/M
Creative Industries					
• Various countries (Animation industry)	L/G	L/G	L	M	L/H
• Barbados (Multimedia)	M	M	M/H	M/H	M/H
• T&T (Music, film, carnival etc.)	H	H	M	H	H
• T&T (Pottery)	L	L	L	L	L
Other Services					
• T&T (Maritime services)	H	H	H	H	H
• T&T (Financial services)	H	H	H		H
• T&T (Business services)	H	H			H
• T&T (Retail)	L	M	L	L	L
• Jamaica (ICT/business services)	M	M	H	H	M/H
• Jamaica (Printing and Packaging)	M	H	M	H	M/H
• Various countries (Maritime services)	L	L	H	M	M

LEGENDA: L = L; M = M; H = H; GROWING = G

Table 5-4 – Caribbean Clusters: Openness

CLUSTERS	Export Orientation	Presence of Multinationals	Involvement in Global Value Chains	Openness
NATURAL RESOURCE BASED				
Agriculture				
- Guyana (Non-traditional agriculture) - Grenada (Nutmeg) - T&T T&T (Agro products in Felicity) - T&T (Agro products in Jerningham)	H H L ABSENT	YES NO NO NO	YES NO NO NO	OPEN SEMI-OPEN CLOSED CLOSED
Agro-processing				
- Guyana (Coconut Water) - T&T (Food Sustainability)	H L	YES NO	YES NO	OPEN CLOSED
Forestry				
Guyana (Forestry and wood products)	H	YES	YES	OPEN
Aquaculture				
- Guyana (Aquaculture) - Belize (Shrimp) - Jamaica (Ornamental fish)	G H M	NO NO NO	NO NO NO	CLOSED/OPENING SEMI-OPEN SEMI-OPEN
Energy				
- T&T (Oil and gas prod and services) - T&T (Point Lisas Industrial Estate)	H H	YES YES	YES YES	OPEN OPEN
MANUFACTURING				
- Guyana (Gold Jewelry) - Various countries (Rum)	L H	NO YES	NO YES	CLOSED OPEN
SERVICES				
Tourism				
- Guyana (Fishing in North Rupunini) - Guyana (Birding) - T&T (Tourism in Carapichaima) - T&T (Tourism) - Jamaica (Treasure beach) - Grenada (Geo-tourism) - Suriname (Upper Suriname River Area)	H H G M M H M	NO NO NO NO NO YES YES	NO YES NO NO YES NO NO	SEMI-OPEN OPEN CLOSED/OPENING SEMI-OPEN SEMI-OPEN OPEN SEMI-OPEN
Creative Industries				
- Various countries (Animation industry) - Barbados (Multimedia) - T&T (Music, film, Carnaval etc.) - T&T (Pottery)	G G G NONE	NO NO NO NO	NO YES YES NO	CLOSED/OPENING OPEN OPEN CLOSED
Other Services				
- T&T (Maritime services) - T&T (Financial services) - T&T (Business services) - T&T (Retail) - Jamaica (ICT/business services) - Jamaica (Printing and Packaging) - Various countries (Maritime services)	H H H ABSENT M INDIRECT EXPORTS H	NO YES NO NO NO NO YES	NO NO NO NO YES YES YES	SEMI-OPEN OPEN SEMI-OPEN CLOSED SEMI-OPEN SEMI-OPEN OPEN

LEGENDA: L = L; M = M; H = H; GROWING = G

Table 5-5 –Caribbean Clusters: Stages of Life Cycle

CLUSTERS	Direct: # of Actors	Systemic: Joint Action (JA) and Open Knowledge Networks (OKN)	Stage of the life cycle
NATURAL RESOURCE BASED			
Agriculture - Guyana (Non-traditional agriculture) - Grenada (Nutmeg) - T&T T&T (Agro products in Felicity) - T&T (Agro products in Jerningham)	INCREASING LARGE INCREASING INCREASING	H JA/ H OKN M JA / L OKN M JA/ M OKN L/M JA / M OKN	GROWTH GROWTH GROWTH GROWTH
Agro-processing - Guyana (Coconut Water) - T&T (Food Sustainability)	INCREASING INCREASING	H JA/ M OKN H JA	GROWTH GROWTH
Forestry Guyana (Forestry and wood products)	INCREASING	M JA/ M OKN	GROWTH
Aquaculture - Guyana (Auqculture) - Belize (Shrimp) - Jamaica (Ornamental fish)	INCREASING INCREASING SMALL	M/H JA/ H OKN M/H JA / M OKN M JA / M OKN	GROWTH GROWTH EMERGENCE
Energy - T&T (Oil and gas prod and services) - T&T (Point Lisas Industrial Estate)	LARGE INCREASING	H JA/ H OKN M/H JA / M OKN	SUSTAINMENT GROWTH
MANUFACTURING			
- Guyana (Gold Jewelry) - Various countries (Rum)	LARGE LARGE	L JA / L OKN H JA / M OKN	SUSTAINMENT SUSTAINMENT
SERVICES			
Tourism - Guyana (Fishing in North Rupunini) - Guyana (Birding) - T&T (Tourism in Carapichaima) - T&T (Tourism) - Jamaica (Treasure beach) - Grenada (Geo-tourism) - Suriname (Upper Suriname River Area)	INCREASING SMALL SMALL LARGE SMALL INCREASING SMALL	H JA/ M OKN M JA/ M OKN L JA/ L OKN M JA/ M OKN M JA / L OKN H JA/ H OKN M JA / L OKN	GROWTH EMERGENCE EMERGENCE SUSTAINMENT EMERGENCE GROWTH EMERGENCE
Creative Industries - Various countries (Animation industry) - Barbados (Multimedia) - T&T (Music, film, Carnaval etc.) - T&T (Pottery)	SMALL SMALL INCREASING LARGE	L/M JA / L OKN L/M JA / M OKN M JA / M OKN M JA/ L OKN	EMERGENCE EMERGENCE GROWTH DECLINE
Other Services - T&T (Maritime services) - T&T (Financial services) - T&T (Business services) - T&T (Retail) - Jamaica (ICT/business services) - Jamaica (Printing and Packaging) - Various countries (Maritime services)	INCREASING LARGE INCREASING LARGE INCREASING INCREASING LARGE	H JA / H OKN H JA / H OKN L/M JA M JA / L OKN M JA / H OKN M JA / M OKN M JA / H OKN	GROWTH SUSTAINMENT GROWTH SUSTAINMENT GROWTH GROWTH GROWTH

LEGENDA: L = L; M = M; H = H; GROWING = G

Table 5- 6 – Caribbean Clusters: Role of Policies

CLUSTERS	Spontaneous cluster	Cluster with policy for inception	Cluster with policy for development
NATURAL RESOURCE BASED			
Agriculture - Guyana (Non-traditional agriculture) - Grenada (Nutmeg) - T&T (Agro products in Felicity) - T&T (Agro products in Jerningham)	YES	YES YES YES	YES
Agro-processing - Guyana (Ccoconut Wwater) - T&T (Food Ssustainability)			YES YES
Forestry Guyana (Forestry and wood products)			YES
Aquaculture - Guyana (Aquaculture) - Belize (Shrimp) - Jamaica (Ornamental fish)	YES	YES	YES YES YES
Energy - T&T (Oil and gas prod and services) - T&T (Point Lisas Industrial Estate)	YES	YES	YES YES
MANUFACTURING			
- Guyana (Gold Jewelry) - Various countries (Rum)	YES		YES
SERVICES			
Tourism - Guyana (Fishing in North Rupunini) - Guyana (Birding) - T&T (Tourism in Carapichaima) - T&T (Tourism) - Jamaica (Treasure beach) - Grenada (Geo-tourism) - Suriname (Upper Suriname River Area)	YES YES	YES YES	YES YES YES YES YES
Creative Industries - Various countries (Animation industry) - Barbados (Multimedia) - T&T (Music, film, Carnaval etc.) - T&T (Pottery)	YES YES	YES	YES YES
Other Services - T&T (Maritime services) - T&T (Financial services) - T&T (Business services) - T&T (Retail) - Jamaica (ICT/business services) - Jamaica (Printing and Packaging) - Various countries (Maritime services)	YES YES YES YES		YES YES YES YES YES

Table 6-1 – Codification of the variables

Variables	Codification
Geographical Dimension	Categorical 1 Local 2 Urban 3 National 4 Inter C 5 L-IC
Organizational Structure	Categorical 1 Marshallian 2 Hub & Spoke 3 Survival
Collective Efficiency • External Economies • Joint Action	Nominal 1 Low 2 Low/Medium 3 Medium 4 Medium/High 5 High
Innovation Capacity	Nominal 1 Low 2 Low/Medium 3 Medium 4 Medium/High 5 High
Openness	Nominal 1 Closed 2 Closed-Opening 3 Semi-Open 4 Open
Stage of Life Cycle	Categorical 1 Emergence 2 Growth 3 Sustainment 4 Decline

Table 6-2 – A Typology of Caribbean Clusters

Type of Cluster (# total)	Names and # of the clusters	Geographical Dimension (# of clusters)	Organizational Structure (# of clusters)	Collective Efficiency (Average Value)		Innovation Capacity (Average Value)	Openness (Average Value)	Stage of Life Cycle (# of clusters)	Policy (# of clusters)
				EE	JA				
Rising Clusters (13)	1.Guyana (Non-Trad Agr) 2.Grenada (Nutmeg) 5.Guyana (Coc Water) 10.Jamaica (Orn. Fish) 14.Inter-Carib (Rum) 15.Guyana (Fishing) 16Guyana (Birding) 19.Jamaica (Treas B.) 20Grenada (Geo-tour) 21.Suriname (Up S R) 22.Inter-Carib (Animat) 23.Barbados (Multimed) 32Inter-Carib (Mar. serv)	Local 3 Urban 1 National 5 Inter-Car 3 Local/Inter-C 1	Marshallian 8 Hub & Spoke 5 Survival 0	2.38	3.77	2.46	3.46	Emergence 6 Growth 6 Sustainment 1 Decline 0	Spontaneous 2 Pol for Incep 3 Pol for Dev 5 Pol for Inc & Dev 0 Spont. + Pol for Dev 3
Sluggish Clusters (8)	3.T&T (Agro products in Felicity) 4.T&T (Agro products in Jerningham) 7.Guyana (For & Wood 13.Guyana (Gold Jew) 17.T&T (Tourism in Carapichaima) 18.T&T (Tourism) 25.T&T (Pottery) 26.T&T (Retail)	Local 4 Urban 1 National 3 Inter-Car 0 Local/Inter-C 0	Marshallian 7 Hub & Spoke 0 Survival 1	2.50	2.50	1.75	1.38	Emergence 1 Growth 3 Sustainment 3 Decline 1	Spontaneous 3 Pol for Incep 1 Pol for Dev 3 Pol for Inc & Dev 1 Spont. + Pol for Dev 0
Innovative Clusters (11)	6.T&T (Food sustain.) 8.Guyana (Aquacult.) 9.Belize (Shrimp) 11.T&T (Oil) 12.T&T (Point Lisas I E) 24.T&T (Music, Film, etc) 26.T&T (Mar. Serv.) 27.T&T (Financ. Serv.) 28.T&T (Business Serv) 30.Jamaica (ICT/Bus) 31.Jamaica (Print & Pack)	Local 1 Urban 2 National 8 Inter-Car 0 Local/Inter-C 0	Marshallian 11 Hub & Spoke 0 Survival 0	4.45	3.91	4.27	3.09	Emergence 0 Growth 9 Sustainment 2 Decline 0	Spontaneous 1 Pol for Incep 0 Pol for Dev 5 Pol for Inc & Dev 2 Spont. + Pol for Dev 3

Appendices

Appendix 1

The main characteristics of the Innovation Systems in the Compete Caribbean beneficiary countries¹⁰

The Bahamas

The main organization focusing STI in the Bahamas is the Bahamas Environment, Science & Technology Commission (BEST). The organization's responsibilities include: serving as a focal point and official contact point for all international organizations with regard to matters relating to the environment, science and technology; supporting scientific and technological advances that may contribute to the development of Bahamas; and, proposing legislation to implement provisions in national plans and environmental policies.

Barbados

In Barbados, the National Council for Science and Technology (NCST) is the highest level organization focusing on science, technology and innovation. Its main functions are to coordinate R&D actions; to collect, process and review scientific and technological information; and, to promote scientific research relating to the development and use of local resources, the improvement of existing technical processes and the development of new processes and methods for their application to the expansion and creation of industries and the use of waste products. The main public agencies performing STI activities include: the Coastal Conservation Management Unit, the Environmental Division of the Ministry of Health & the Environment, the Barbados Agricultural Management Company Limited (responsible for the management of the sugar industry and performs R&D activities in the field), a campus of the University of the West Indies (UWI) and the Bellair Research Institute (marine research unit of McGill University in Canada).

Dominican Republic

In the Dominican Republic, the National System of Innovation and Technological Development (SNIDT) is organized through the Council for Innovation and Technological Development (CIDT), which represented different governmental agencies related to innovation and technology and import productive sectors of the economy. The State Secretariat of Higher Education, Science and Technology (SEESCYT) is SNIDT's central authority and responsible for formulating public policies. The National Fund for Innovation and Scientific and Technological Development (FONDOCYT) funds scientific research and scientific-technological development. The National Council of the Private Enterprise (CONEP) allows businesses to interact to collectively promote their own interests. The National Competitiveness Council (CNC) promotes competitiveness. The eMprende Project is an incubator for new technological businesses.

The Dominican Republic has several institutions and programs focused on training. The National Institute of Technical-Vocational Education (INFOTEP) is the governing body of the National System of Education for Productive Work, seeks to train workers for the national productive sector, give advice to enterprises and regulate national level professional education. The Dominican Republic also houses a variety of educational institutes that contribute supporting human resources for STI activities, which include: Loyola Specialized Institute of Higher Studies (offering professional education in industrial engineering and networks and telecommunications

¹⁰ The following information is largely drawn from 'National Science, Technology and Innovation Systems in Latin America and the Caribbean' (Lemarchand, 2010)

engineering), Higher Institute of Agriculture (ISA), Technological Institute of Oriental Cibao (ITECO), Catholic University, Ibero-American University (UNIBE), National University-Institute of Exact Sciences (UNINCE), Technological Institute of Santo Domingo (INTEC), Autonomous University of Santo Domingo (UASD), National University Pedro Henriquez Ureña (UNPHU), University for Agroforestry Fernando Arturo de Meriño (UAFAM), Technological University of Santiago (UTESA), and APEC University (UNAPEC). Additionally, scholarships are given by the Las Americas Institute of Technology (ITLA) for ongoing education courses given in the fields of mechatronics, multimedia, information technology, software and English.

The International Advisory Commission for Science and Technology (CIACT) seeks to position the Dominican Republic as a major influencer of science and technology issues in Latin America. The government has also implemented 10-year plans for higher education (Plan Decenal de Educación Superior 2008-2018, PDES) and for science technology and innovation (Plan Decenal de Ciencia, Tecnología e Innovación 2008-2018, PECYT+I).

Guyana

The National Science and Research Council (NSRC) of Guyana coordinates and implements national science and technology policy. Their main responsibilities are to formulate the national plan on science and technology, coordinate activities in the sector; develop links between science and technology institutions and the entrepreneurial sector, provide scientific and technological information to governmental and private bodies, support basic research programs at all levels, stimulate research in areas of national interest, improve the use of natural resources, improve the quality of life of rural and indigenous population through the preservation of their technologies and the development of new ones, promote education and training in the field of science and technology and promote regional and international links with science and technology organizations. The Institute of Applied Science and Technology (IAST), is the industrial research body in charge of developing and adopting technologies to optimize the use of natural resources in the country with responsibilities including serving as central body of research, development and transfer of technology; developing data bases on different areas of scientific research and technological innovation; facilitating science and technology training; and, participating in the articulation of national policies.

Priority areas related to R&D in Guyana include the development of mining, forest development, manufacturing, information technologies, telecommunications, agriculture, transfer of technologies and the environment. Entities in charge of performing R&D in Guyana include: the Environmental Protection Agency; the Guyana Agency for Health, Education and Food; the Guyana Forestry Commission; the Guyana Geology and Mines Commission; the Guyana Natural Resources Agency; the Guyana Rice Development Board; the Guyana Sugar Corporation; the Hydrometeorological Office; Iwokrama International Centre for Rain Forest Conservation and Development; the Ministry of Agriculture; the Ministry of Fisheries, Crops and Livestock; the National Agriculture Research Institute; and, the University of Guyana.

Haiti

The main science, technology and innovation organization in Haiti is the Direction of Higher Education and Scientific Research (DESRS) under the authority of the Ministry of National Education, Youth and Sports (MENJS). The MENJS has a national education and training plan aimed at improving the quality of the education system at all levels and to strengthen the ministry's own management and planning capacity. R&D activities take place through several organizations. These are the Haiti State University, Quisqueya University, the Centre of Planning Techniques and Applied Economics and the Superior National School of Technology (ENST).

Jamaica

Jamaica's science, technology and innovation system is based around three institutions. The first is the National Commission on Science and Technology (NCST), which is the governmental advisory body on the subject of science and technology policy, promotion and strategic management. Comprised of representatives from public and private institutions, its aim is to encourage social and economic development through science and technology. The second is the National Foundation for Development of Science & Technology, which seeks to assist in the funding of the NCST operations and raise public awareness of science and technology. The third is the Scientific Research Council (SRC), an agency of the Ministry of Industry, Commerce and Technology, which is the main public body responsible for supporting and coordinating research and seeking for its dissemination and application to national resources development. They support the growth and development of the agro-industrial sector through research, adaptation of existing technologies, creation of new technologies, training and technical assistance. The Jamaican national Policy on Science and Technology was produced in 2005.

Jamaica also has several educational programs, which support innovation. The University of Technology (UTech) houses the Scotiabank Chair in Entrepreneurship and Development whose objective is to facilitate the growth of entrepreneurship and support SMEs in Jamaica and other CARICOM countries. UTech also guides and supports entrepreneurial activities through consultancy services and the creation of R&D innovations. Jamaica also has the R&D Tax Incentive Scheme, which allows R&D projects to apply for customs duty exemptions for relevant material. The Technology Investment Fund (TIF) provides funding for investments in commercial activities related to technological improvements and supports commercial projects, which do not meet the requirements of other funders. The Human Employment and Resource Training Trust / National Training Agency (HEART Trust)/(NTA) provides access to training, evaluation of skills and certification, and by offering services for facilitating employment and professional development. Additional education institutions supporting innovation in Jamaica include: Institute of Jamaica, and the University of the West Indies (UWI), with campuses in Cave Hill (Barbados), Mona (Jamaica), and St. Augustine (Trinidad and Tobago).

Jamaica participates in global cooperation to support innovation through the International Centre for Environmental and Nuclear Science (ICENS), a multidisciplinary research centre; the Caribbean Agricultural Research and Development Institute (CARDI), an organization of Caribbean countries supporting agricultural research that performs STI activities in Jamaica; and, the National Contact Points for the Seventh Framework Programme of the European Community for research, technological development and demonstration activities (FP7), involving a cycle of events and training activities for promoting the participation of Jamaica in EU cooperation funds.

Saint Vincent and the Grenadines

In Saint Vincent and the Grenadines the Unit of Science and Technology of the Ministry of Telecommunications, Sciences, Technology and Industry is the main organization responsible for science, technology and innovation activities. The organizations objectives are: the execution of the action program of the Council for Technology, Research and Industrial Development; to act as focal point for regional and international agencies with the aim of evaluating potential benefits resulting from the participation of Saint Vincent and the Grenadines in several forums; to establish and strengthen links between interest groups, to avoid the overlapping of efforts and to favor joint undertakings; and, to identify new initiatives for the promotion of Science and Technology. The Unit of Science and Technology funds projects in priority areas including climate change and little insular states, renewable energy, biofuel and capacity development.

Trinidad and Tobago

In Trinidad and Tobago the Ministry of Tertiary Education and Skills Training seeks to create a strong human resource pool. Programs are geared toward developing a more diversified and knowledge intensive economy. The ministry has introduced new and accredited qualification schemes such as the Caribbean Vocation Qualification (CVQ). Additionally, it has launched a number tertiary education and technical vocational education training programs, which include: the Government Assistance for Tuition Expenses (GATE) program, the Higher Education Loan (HELP) program, promoting distance learning, the Higher Education Services Division (HESD) and Technical and Vocational Education and Training (TVET) Division.

The Government of Trinidad and Tobago established the Council for Competitiveness and Innovation (CCI) in 2011 as an advisory board to the Ministry of Planning and Sustainable Development. Its main responsibilities are to improve Trinidad and Tobago's global competitiveness and foster innovation as a key driver of a diversified knowledge based economy. The CCI is assist in the development of a new innovation policy. The CCI launched the Idea 2 Innovation (i2i) Competition which provides access to grants to move ideas to the proof of concept stage. The project is run in collaboration with the Caribbean Industrial Research Institute (CARIRI). Other organizations involved in national STI policies are the University of the West Indies; the University of Trinidad and Tobago; the National Institute of Higher Education, Research, Science and Technology (NIHERST); the Institute of Marine Affairs; Ministry of Agriculture, Land and Marine Resources; the Ministry of Energy; the Ministry of Public Administration and Information; the Ministry of Trade and Industry; the Ministry of Health; the Caribbean Epidemiology Centre (CAREC); the Caribbean Agricultural Research and Development Institute (CARDI); and the Caribbean Health Research Council.

Policies introduced in Trinidad and Tobago which may stimulate innovation include: the law of income tax exemption in aid of industry being extended to all manufacturing activities and the ratification of the income tax law in 2006 which allows the productive sector to deduct the resources used for the development of human resources up to 150%. The government's Business Expansion and Industrial Reengineering Program (BEIRP) is helping to redesign national enterprises to increase incorporation of technological and innovative processes as well as broadening innovative capacity and producing products of high added value for the international market.

Additionally, in Trinidad and Tobago the Ministry of Planning and Sustainable Development has identified six strategic business clusters (energy, food sustainability, culture and creative industries, maritime, tourism and financial services) which will be supported by critical enabling inputs which include information, communication and technology (ICTs); research and development (R&D); education and training; infrastructure (roads, utilities, air and sea ports); intellectual property; and, business incentives and financial services. This initiative is intended to promote increased efficiency, higher productivity levels, generate jobs, and facilitate innovation.

Several organizations in Trinidad and Tobago seek to support SMEs. The Business Development Company (BDC) and the Enterprise Development Division (EDD) of the Ministry of Labour and SME Enterprise Development seek to support SMEs. The National Entrepreneurship Development Company (NEDCO)'s main mandate is to manage loans for SMEs and also offers a series of support services in education, entrepreneurial development, business consultancy and coaching services. One of its initiatives is the Entrepreneurial Training Institute Incubation Centres (ETIIC) which seeks to consolidate feasibility of enterprises within the STI scope by providing a variety of support services. The Caribbean Business Services Limited (CBSL) seeks to promote

competitiveness and export opportunities of manufacturing and service SMEs in sectors other than energy.

Other organizations in Trinidad and Tobago that support innovation consider cooperative between institutions. The European Development Fund (EDF) seeks to support new knowledge through university-enterprise cooperation; to promote incorporation of processes that enable a higher added value of production as well as innovating activities and activities aimed at promoting the exports by SME; to promote the concept of “innovation culture” to develop and connect risk capitals, promote R&D direction towards market demands and to promote entrepreneurial capacities. A “Knowledge Centre” has also been created by the Ministry of Planning and Development to disseminate information regarding better practices of monitoring and evaluation in the fields of project management.

The Trade Sector Support Program (TSSP) is designed to improve the international trade performance of Trinidad and Tobago. The government is currently in the process of developing a national innovation policy and a national ICT plan. Collaboration between public and private sectors has been scarce and needs to be promoted (Lemarchand 2010).

According the (UNESCO 2010), Antigua and Barbuda, Belize, Dominica, Grenada, Saint Kitts and Nevis, Saint Lucia and Suriname do not have agencies with the exclusive responsibility of promoting science, technology and innovation. In these countries, issues related with innovation and technology are managed by Ministries of “planning”, “education, youth and sports” or “commerce and industry”.

Appendix 2

Cluster Reference Documents

Clusters	Cluster Reference Documents
NATURAL RESOURCE BASED	
Agriculture	
Guyana (Non-traditional Agriculture)	- OTF Group. (2010), Cluster Best Practices for the Caribbean Private Sector Development, Discussion Paper 5, September, Washington, DC: Inter-American Development Bank. - CARANA Corporation. (2009), Guyana Trade and Investment Support Final Report, April, Washington, DC: USAID. - Inter-American Institute for Cooperation on Agriculture. (2011), IICA Technical Cooperation Strategy in Guyana 2011-2014, San Jose, Costa Rica: IICA. - Ministry of Agriculture. (2014), Guyana Marketing Corporation, Georgetown, Guyana: Ministry of Agriculture [online] www.newgmc.com (accessed: July 26, 2014).
Grenada (Nutmeg)	- Ffowcs-Williams, I. (2013), Cluster Competitiveness Improvement Plan Upgrading Grenada's Nutmeg Cluster, July, Christ Church, Barbados: Compete Caribbean. - Government of Canada. (2013), Nutmeg is crucial to Grenada's economy and Canada is helping to improve it, Ottawa, Canada: Government of Canada [online] http://www.canadainternational.gc.ca/barbados-barbade/eyes_abroad-coupdoeil/nutmeg-muscade.aspx?lang=eng (accessed: July 26, 2014).
T&T (Agro products in Felicity)	Ramsawak, R., Carrillo, M., Lezama, S., Ali, J., Ali, S. and Pacheco, M. (2013), Competitive Analysis of the 4C Growth Pole: Opportunities for Cluster and Business Development, January, St Augustine, Trinidad and Tobago: Arthur Lok Jack Graduate School of Business, the University of the West Indies.
T&T (Agro products in Jerningham)	Ramsawak, R., Carrillo, M., Lezama, S., Ali, J., Ali, S. and Pacheco, M. (2013), Competitive Analysis of the 4C Growth Pole: Opportunities for Cluster and Business Development, January, St Augustine, Trinidad and Tobago: Arthur Lok Jack Graduate School of Business, the University of the West Indies.
Agro-processing	
Guyana (Coconut Water)	- Compete Caribbean. (2013), Compete Caribbean Plan of Operations: Establishment of the Pomeroon Producers Association, Project Number RG-CC3059, October, Christ Church, Barbados: Compete Caribbean. - Webber, B. (2013), Cluster Competitiveness Improvement Plan for The Lower Pomeroon Coconut Cluster, October, Christ Church, Barbados: Compete Caribbean.
Trinidad and Tobago (Food Sustainability)	Ministry of Planning and Sustainable Development. (2012), Building Competitive Advantage: Six Strategic Business Clusters and Enablers, July, Port-of-Spain, Trinidad and Tobago: Ministry of Planning and Sustainable Development.
Forestry	
Guyana (Forestry & Wood Products)	OTF Group. (2010), Cluster Best Practices for the Caribbean Private Sector Development, Discussion Paper 5, September,

	Washington, DC: Inter-American Development Bank. • CARANA Corporation. (2009), Guyana Trade and Investment Support Final Report, April, Washington, DC: USAID. • Bholanath, P. and Soderstrom, L. (2012), Guyana Forestry Industry Cluster, CCIP, Competitiveness Improvement Plan and Grant Application, RG-X1044, November, Christ Church, Barbados: Compete Caribbean.
Aquaculture	
• Guyana (Aquaculture)	• OTF Group. (2010), Cluster Best Practices for the Caribbean Private Sector Development, Discussion Paper 5, September, Washington, DC: Inter-American Development Bank. • CARANA Corporation. (2009), Guyana Trade and Investment Support Final Report, April, Washington, DC: USAID.
• Belize (Shrimp)	• Webber, B. (2013), Final Draft: Cluster Competitiveness Improvement Plan for the Belize Shrimp Cluster, July, Christ Church, Barbados: Compete Caribbean. • Compete Caribbean. (2013), Preparing Belize Shrimp Growers Association for ASC Shrimpt Certification to Improve Its Competitiveness Project Number: BL-CC3005 Plan of Operations, August, Christ Church, Barbados: Compete Caribbean. • Myvett, G. (2005), National Aquaculture Sector Overview Belize. National Aquaculture Sector Overview Fact Sheets. Rome, Italy: FAO Fisheries and Aquaculture Department [online] http://www.fao.org/fishery/countrysector/naso_belize/en (accessed, July 26, 2014).
• Jamaica (Ornamental Fish)	• Compete Caribbean. (2013), Plan of Operations Cluster, Collaborate, Export and Thrive: The Growth of an Ornamental Fish Industry in Urban Communities in Jamaica, Project Number JA-CC3053, October, Ottawa, Canada: Government of Canada. • Willis, S. (2013), Cluster Competitiveness Improvement Plan for The Competitiveness Company and Jamaica Ornamental Fish Cluster, October, Christ Church, Barbados: Compete Caribbean.
Energy	
• T&T (Oil & Gas Products & Services)	• Ministry of Planning and Sustainable Development. (2012), Building Competitive Advantage- Six Strategic Business Clusters and Enablers, July, Port-of-Spain, Trinidad and Tobago: Ministry of Planning and Sustainable Development. • The Energy Chamber of Trinidad and Tobago. (2014), San Fernando, Trinidad and Tobago: The Energy Chamber of Trinidad and Tobago [online] www.energy.tt (accessed July 26, 2014).
• T&T (Point Lisas Industrial Estate)	• Driver, T. (2011), The Point Lisas Petrochemical and Metal Industry Cluster, Port of Spain, Trinidad and Tobago: Regional Forum on Cluster Development [conference proceedings]. • Ramsawak, R., Carrillo, M., Lezama, S., Ali, J., Ali, S. and Pacheco, M. (2013), Competitive Analysis of the 4C Growth Pole: Opportunities for Cluster and Business Development, January, St Augustine, Trinidad and Tobago: Arthur Lok Jack Graduate School of Business, the University of the West Indies.

MANUFACTURING	
Guyana (Gold Jewelry)	- DaSilva-Glasgow, D. (2013), Global Value Chain Analysis of the Gold Jewellery Industry: Upgrading Trajectories for Guyana, , April, St Augustine, Trinidad and Tobago: Caribbean Centre for Competitiveness, Institute for Critical Thinking, University of the West Indies. - DaSilva-Glasgow, D. (2013), Global Value Chains Analysis of the Gold Jewellery Industry: Upgrading Trajectories for Guyana, June, Greater Georgetown, Guyana: University of Guyana.
Various Countries (Rum)	- Braun-Munzinger, C. (2011), Accompanying Trade Liberalisation through Regional Industrial Policy: A Case Study of the EU Aid for Trade Programme to the Caribbean Rum Sector, Manchester, UK: University of Manchester. - Braun-Munzinger, C. and Goodison, P. (2010), Trade and Production Adjustments in ACP Countries: Lessons from the Caribbean Rum Programme, Discussion Paper 97, May, Wageningen, The Netherlands: European Centre for Development Policy Management. - Dunlop, A. (2004), A Strong Cocktail or a Weak Punch? A Case Study of EDF Assistance to the ACP Private Sector, Discussion Paper 52, January, Wageningen, The Netherlands: European Centre for Development Policy Management. - Reid, R. (2011), Best Practices in Caribbean Agribusiness Cluster Development, Port of Spain, Trinidad and Tobago: Regional Forum on Cluster Development [conference proceedings].
SERVICES	
Tourism	
Guyana (Fishing in North Rupini)	- Compete Caribbean. (2013), Compete Caribbean Plan of Operations: Catch and Release Sport Fishing in the North Rupunini, Project Number GY-CC3002, September, Christ Church, Barbados: Compete Caribbean. - Dellavedova, M. (2013), Cluster Competitiveness Improvement Plan, Catch and Release Sport Fishing in the North Rupunini, June, Christ Church, Barbados: Compete Caribbean.
Guyana (Birding)	- OTF Group. (2010), Cluster Best Practices for the Caribbean Private Sector Development Discussion Paper 5, Sepember, Washington, DC: Inter-American Development Bank. - CARANA Corporation. (2009), Guyana Trade and Investment Support Final Report, April, Washington, DC: USAID.
T&T (Tourism in Carapichaima)	Ramsawak, R., Carrillo, M., Lezama, S., Ali, J., Ali, S. and Pacheco, M. (2013), Competitive Analysis of the 4C Growth Pole: Opportunities for Cluster and Business Development, January, St Augustine, Trinidad and Tobago: Arthur Lok Jack Graduate School of Business, the University of the West Indies.
T&T (Tourism)	- Ministry of Planning and Sustainable Development. (2012), Building Competitive Advantage-Six Strategic Business Clusters and Enablers, July, Port-of-Spain, Trinidad and Tobago: Ministry of Planning and Sustainable Development. - Ministry of Tourism. (2010), National Tourism Policy of Trinidad and Tobago, October, Port of Spain, Trinidad and Tobago:

	Ministry of Tourism.
Jamaica (Treasure beach)	- Compete Caribbean. (2013), Compete Caribbean Plan of Operations: Local Economic Development in Treasure Beach, Project Number JA-CC3008, September, Christ Church, Barbados: Compete Caribbean. - Morgan, B. (2013), Cluster Competitiveness Improvement Plan for the Treasure Beach Cluster, January, Christ Church, Barbados: Compete Caribbean.
Grenada (Geo-tourism)	Ffowcs-Williams, I. (2013), Cluster Competitiveness Improvement Plan Upgrading Grenada's Nutmeg Cluster, July, Christ Church, Barbados: Compete Caribbean.
Suriname (Upper Suriname River Area)	- Boyd, A. (2013), Cluster Competitiveness Improvement Plan Suriname Rainforest Experience Cluster Name: Suriname Tourism Cluster, November, Christ Church, Barbados: Compete Caribbean. - Compete Caribbean. (2013), Compete Caribbean Plan of Operations: Suriname Rainforest Experience Cluster, Project Number SU-CC3058, Christ Church, Barbados: Compete Caribbean.
Creative Industries	
Various countries (Animation industry)	- Compete Caribbean. (2013), Cluster Competitiveness Improvement Plan Program RG-X1044 Barbados And Caribbean Cluster Initiative for Animation Outsourcing and Intellectual Property Development Barbados and Jamaica, June, Christ Church, Barbados: Compete Caribbean. - Compete Caribbean. (2013), Compete Caribbean Plan of Operations: Caribbean Cluster Initiative for Animation Outsourcing and Intellectual Property Development, Project Number RG-CC3056, Christ Church, Barbados: Compete Caribbean.
Barbados (Multimedia)	Grysole, J. (2013), Compete Caribbean Plan of Operations The Caribbean Creative Cluster Draft Competitiveness Improvement Plan Project: Trident Studios Barbados, November, Project Number RG-X1044, Christ Church, Barbados: Compete Caribbean.
T&T (Music, Film, Carnival, etc.)	- Ministry of Planning and Sustainable Development. (2012), Building Competitive Advantage-Six Strategic Business Clusters and Enablers, July, Port-of-Spain, Trinidad and Tobago: Ministry of Planning and Sustainable Development. - Nurse, K., Reis, M., Morris, J., Greenidge, C. and Marsh, N. (2006), NIHERST Sector Foresight Project: Creative: Chapter 3: Overall T & T 'Best Bets', September, St Augustine, Trinidad and Tobago: National Institute of Higher Education, Research, Science and Technology.
T&T (Pottery)	Ramsawak, R., Carrillo, M., Lezama, S., Ali, J., Ali, S. and Pacheco, M. (2013), Competitive Analysis of the 4C Growth Pole: Opportunities for Cluster and Business Development, January, St Augustine, Trinidad and Tobago: Arthur Lok Jack Graduate School of Business, the University of the West Indies.

Other services	
• T&T (Maritime services)	• Ministry of Planning and Sustainable Development. (2012), Building Competitive Advantage-Six Strategic Business Clusters and Enablers, July, Port-of-Spain, Trinidad and Tobago: Ministry of Planning and Sustainable Development. • Ministry of Trade. (2014), Trinidad andTobago's Maritime Industry, June, Port of Spain, Trinidad and Tobago: Ministry of Trade, Industry, Investment and Communications. • SATT. (2014), The Shipping Association of Trinidad and Tobago, Port of Spain, Trinidad and Tobago: The Shipping Association of Trinidad and Tobago [online] http://shipping.co.tt/about.php (accesssed: July 26, 2014).
• T&T (Financial Services)	• Ministry of Planning and Sustainable Development. (2012), Building Competitive Advantage-Six Strategic Business Clusters and Enablers, July, Port-of-Spain, Trinidad and Tobago: Ministry of Planning and Sustainable Development. • Raghunandan, M., Ramgulam, N., Raghunandan-Mohammed, K., and Allaham, I. (2012), Emerging Issues on the Horizon: Financial Services Industry in Trinidad and Tobago, International Journal of Humanities and Social Science, 2, 17: 55-69.
• T&T (Business Services)	• Ramsawak, R., Carrillo, M., Lezama, S., Ali, J., Ali, S. and Pacheco, M. (2013), Competitive Analysis of the 4C Growth Pole: Opportunities for Cluster and Business Development, January, St Augustine, Trinidad and Tobago: Arthur Lok Jack Graduate School of Business, the University of the West Indies.
• T&T (Retail)	• Ramsawak, R., Carrillo, M., Lezama, S., Ali, J., Ali, S. and Pacheco, M. (2013), Competitive Analysis of the 4C Growth Pole: Opportunities for Cluster and Business Development, January, St Augustine, Trinidad and Tobago: Arthur Lok Jack Graduate School of Business, the University of the West Indies.
• Jamaica (ICT/Business Services)	• Compete Caribbean. (2013), Compete Caribbean Plan of Operations: Strengthening Innovation and Entrepreneurship within the ICT/BPO Industry through Physical and Virtual Incubation, Project Number JA-CC3060, Christ Church, Barbados: Compete Caribbean. • Dellavedova, M. (2013), Cluster Competitiveness Improvement Plan for Developing Opportunities for the Business Process Outsourcing Industry in Jamaica, October, Christ Church, Barbados: Compete Caribbean.
• Jamaica (Printing & Packaging)	• Gannes, R. (2013), The Printing and Packaging Cluster of Jamaica Competitiveness Improvement Plan, October, Christ Church, Barbados: Compete Caribbean.
• Various Countries (Maritime Services)	• OECS Secretariat. (2013), Compete Caribbean: OECS Maritime Shipping Cluster Competitiveness Improvement Plan, March, Christ Church, Barbados: Compete Caribbean.

Appendix 3

The cluster analysis

Table A1: Cluster Membership

Cluster name	Code Cluster	Type of cluster (Code)	Type of cluster (Name)
Guyana (Non-traditional agriculture)	1	1	Rising Clusters
Grenada (Nutmeg)	2	1	Rising Clusters
T&T (Agro products in Felicity)	3	2	Sluggish Clusters
T&T (Agro products in Jerningham)	4	2	Sluggish Clusters
Guyana (coconut water)	5	1	Rising Clusters
T&T (Food sustainability)	6	3	Innovative Clusters
Guyana (Forestry and wood products)	7	2	Sluggish Clusters
Guyana (aquaculture)	8	3	Innovative Clusters
Belize (Shrimp)	9	3	Innovative Clusters
Jamaica (Ornamental fish)	10	1	Rising Clusters
T&T (Oil and gas prod. and services)	11	3	Innovative Clusters
T&T (Point Lisas Industrial Estate)	12	3	Innovative Clusters
Guyana (Gold Jewelry)	13	2	Sluggish Clusters
Various countries (Rum)	14	1	Rising Clusters
Guyana (Fishing in North Rupini)	15	1	Rising Clusters
Guyana (Birding)	16	1	Rising Clusters
T&T (Tourism in Carapichaima)	17	2	Sluggish Clusters
T&T (Tourism)	18	2	Sluggish Clusters
Jamaica (Tresure beach)	19	1	Rising Clusters
Grenada (Geo-tourism)	20	1	Rising Clusters
Suriname (Upper Suriname River Area)	21	1	Rising Clusters
Various countries (Animation industry)	22	1	Rising Clusters
Barbados (Multimedia)	23	1	Rising Clusters
T&T (Music, film, carnival etc.)	24	3	Innovative Clusters
T&T (Pottery)	25	2	Sluggish Clusters
T&T (Maritime services)	26	3	Innovative Clusters
T&T (Financial services)	27	3	Innovative Clusters
T&T (Business services)	28	3	Innovative Clusters
T&T (Retail)	29	2	Sluggish Clusters
Jamaica (ICT/business services)	30	3	Innovative Clusters
Jamaica (Printing and Packaging)	31	3	Innovative Clusters
Various countries (Maritime services)	32	1	Rising Clusters

Table A2: ANOVA AND BONFERRONI TESTS ON GROUP DIFFERENCES

		Number of Clusters	Mean	Standard Deviation.	Standard Error	ANOVA Sig.
External Economies (EE)	1	13	2.38	.768	.213	.000
	2	8	2.50	.756	.267	
	3	11	4.45	.934	.288	
	Total	32	3.13	1.264	.223	
Joint Action (JA)	1	13	3.77	.832	.231	.008
	2	8	2.50	1.195	.423	
	3	11	3.91	.944	.285	
	Total	32	3.50	1.107	.196	
Innovation Capacity	1	13	2.46	.877	.243	.000
	2	8	1.75	.707	.250	
	3	11	4.27	.786	.237	
	Total	32	2.91	1.304	.231	
Openness	1	13	3.46	.660	.183	.000
	2	8	1.38	.744	.263	
	3	11	3.09	.944	.285	
	Total	32	2.81	1.148	.203	

Test post hoc

Variable	(I) # of cases in clusters	(J) Cluster #	Mean Differences (I-J)	Standard Error	Sig.
EE	1	2	-.115	.371	1.000
		3	-2.070	.339	.000
	2	1	.115	.371	1.000
		3	-1.955	.384	.000
	3	1	2.070	.339	.000
		2	1.955	.384	.000
JA	1	2	1.269	.435	.020
		3	-.140	.397	1.000
	2	1	-1.269	.435	.020
		3	-1.409	.450	.012
	3	1	.140	.397	1.000
		2	1.409	.450	.012
Innovation Capacity	1	2	.712	.363	.179
		3	-1.811	.331	.000
	2	1	-.712	.363	.179
		3	-2.523	.375	.000
	3	1	1.811	.331	.000
		2	2.523	.375	.000
Openness	1	2	2,087	,354	,000
		3	,371	,323	,781
	2	1	-2,087	,354	,000
		3	-1,716	,366	,000
	3	1	-,371	,323	,781
		2	1,716	,366	,000

**TABLE A3: STATISTICS ON NOMINAL VARIABLES
AND PHI-TESTS ON GROUP DIFFERENCES**

		Number of cases per Cluster group			Total
		1	2	3	
<i>Geographical Dimension</i>	Sub-national	3	4	1	8
	Urban	1	1	2	4
	National	5	3	8	16
	Inter-Caribbean	3	0	0	3
	Sub-national and Inter-Caribbean	1	0	0	1
Phi Test (Sig.)		.189			
<i>Organizational Structure</i>	Marshallian	8	7	11	26
	Hub and Spoke	5	0	0	5
	Survival	0	1	0	1
Phi Test (Sig.)		.022			
<i>CLC</i>	Emerging	6	1	0	7
	Growing	6	3	9	18
	Sustainment	1	3	2	6
	Decline	0	1	0	1
Phi Test (Sig.)		.035			
<i>Policy</i>	Spontaneous	2	3	1	6
	Policy from Inception	3	1	0	4
	Policy for Development	5	3	5	13
	Policy for Inception and Development	0	1	2	3
	Spontaneous Cluster plus Policy for Development	3	0	3	6
Phi Test (Sig.)		.340			