Governing from the future, leading with inclusion:

Policies, prospects, and pathways for Aruba 2040

Centrale Bank van Aruba

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Governing from the Future – Leading with Inclusion.
Prospects, policies, and pathways for Aruba 2040.

The views expressed in this report are those of the respective author(s) and do not represent necessarily the perspective of the Centrale Bank van Aruba.

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Foreword *Governing from the Future – Leading with Inclusion*

Dear Reader,

At the Centrale Bank van Aruba (CBA), we serve the public interest and contribute to the wellbeing of the Aruban community. We do so by maintaining the value of the florin against the US dollar, promoting the soundness and integrity of the financial system, as well as fostering efficient and reliable payment systems. In the execution of our tasks, we play a partnering role in the necessary and just transition to an inclusive and resilient Aruba. Because we want to, because we can, because it is expected of us, but also because this is the time to do it.

Considering present economic conditions, we have ample opportunities – if expertly, responsibly, and expeditiously tapped -- to transform our island into a financially-independent community, with a vibrant and resilient economy, healthy and thriving ecosystems, as well as a flourishing productive population in which everyone is included. Therefore, our mission is also to contribute meaningfully towards realizing this vision of increasing the inclusive resilience of our island, its economy, people, and biodiversity. Hence, we think beyond sustainability to regeneration. We focus on transitioning CBA's operations, the financial system, and the economy to a regenerative, inclusive, and resilient system, driven by data-centric and evidence-based capabilities.

Governing with foresight requires key policy and decision makers to sharpen their focus, unlearn in order to relearn, and dare to lean boldly into the future. By making this impactful choice, we realize that we share in the responsibility to foster financial stability and economic wellbeing. While there is little doubt that the Aruban economy and community have grown – in terms of output and population –, the quest for inclusive development, the wellbeing of the Aruban economy and the health of our biodiverse ecosystems have become even more urgent amidst an increasingly volatile, uncertain, complex, and ambiguous environment.

The institutional capability to shift swiftly from reacting to the present and reproducing the past, to impactfully leading from an emerging future is pivotal. The more profound and enduring the changes and challenges in our society and nature, the less our existing social, political and economic institutions

can rely on past policies and paradigms. Consequently, we must draw on emerging future opportunities for the development of strategic foresight and early-warning systems. The aforementioned strategies and systems are essential for strengthening robust and effective public policy and decision making in order to safeguard our economic wellbeing.

To this end, we offer a sequal to our first edition of Governing from the Future – Leading with Impact. This second reinforced edition on Governing from the Future – Leading with Inclusion studies and discusses the fundamental importance of inclusive development for strengthening our resilience as a small island state in the throes of transformation. Inclusive development is commonly understood as an equitable development approach built on the values that every individual and community, of all diverse identities and experiences, are pivotal to the resilience of their societies. Inclusive development embraces social, ecological, and relational inclusiveness. The unconditional engagement of all citizens throughout economic development – not just economic growth – leads to inclusive intergenerational benefits, as well as intragenerational impacts.

Inclusive resilience is the ability of a system, community, or society to absorb, accommodate, adapt, and transform from the adverse effects of economic and non-economic downturns and disruptions in a timely and efficient manner, as well as in a responsible, just, and fair transition towards the future. Leading inclusive resilience aims at building resilient societies, economies, and ecologies that value and empower all, including community and nature.

We wholeheartedly invite you to read this second edition of *Governing from the Future – Leading with Inclusion.* First and foremost, as guidance for a much-needed open, inclusive, and future-oriented discussion. This collective dialogue is required to sharpen our focus on achieving impactful and responsible outcomes, in addition to developing our shared ability to adapt effectively and transform responsibly. The CBA is committed towards providing the requisite platform to advance the increasingly urgent dialogue for the targeted transformative changes.

In this publication, we investigate and scrutinize various themes at the heart of inclusive resilience. We address the nexus between ***human development and economic growth***

(see Chapter 2), as well as ***the future of work and digital transformation*** (see Chapter 3). The adoption of a **retail digital Aruban florin**, in addition to achieving an **inclusive energy transition** are discussesed in Chapter 4 and Chapter 5, respectively. This book concludes with an exploratory study on **developments and drivers of affordable housing in Aruba** and the Dutch Caribbean (Curacao and St. Maarten), and proposes a new Aruban Urban Agenda (AUA) for safeguarding access to affordable housing to strengthen inclusive development (see Chapter 6).

Governing from the Future – Leading with Inclusion is another important milestone in continuously adapting and transforming to a constantly changing reality. If we rise to the occasion and heed the call of the future, we will succeed in our greater goal: to enable inclusive resilience by and for all.

Jeanette R. Semeleer
President
Aruba, May 2024

List of key terms and definitions

Affordable housing: The cost of housing services and shelter relative to a household's income.

Central bank digital currency (CBDC): A CBDC is a digital currency issued by a central bank.

Digital currency: An electronically created and - stored currency.

Digital florin: A digital currency issued by the CBA.

Digital skills: The range of abilities to use digital devices, communication applications, and networks to access and manage information.

Economic growth: the total increase in the value of goods and services produced in a country during a period of time. Economic growth is commonly measured in changes to the gross domestic product (GDP).

Energy mix: the variety of sources a region uses to meet its energy demands.

Housing affordability: Measures the relationship between expenditure on housing costs (e.g., price, mortgage payments or rents) and household incomes (also known as the 'price-to-income' ratio).

Housing burden: Measures the housing cost-to-(disposable) income ratio (e.g., rent-to-income, mortgage payments-to-income; share of households spending over 40% of disposable income on housing costs.

Human development: an approach in the development field focusing on expanding the richness of human life, rather than simply the richness of the economy in which human beings live. It is an approach that is focused on creating fair opportunities and choices for all people.

Informal economy: Unregistered economic activities that have market value and would add to tax revenue and Gross Domestic Product if formally recorded and registered in national accounts.

Inclusive energy transition: A way of shifting to renewable energy sources that ensures everyone benefits and isn't left behind. It focuses on making sure the transition is fair and creates positive social and economic outcomes for all.

Inclusive growth: Growth that is distributed fairly across society and creates opportunities for all.

Inclusive resilience: the ability of a system, community or society to, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, as well as in a responsible, just, and fair transition towards the future.

Resilience: The ability of households, communities and nations to absorb and recover from shocks, while positively adapting and transforming their structures and means for living in the face of long-term stress, change and uncertainty.

Renewed energy installed capacity: the maximum amount of electricity that renewable energy sources can potentially generate at a given time. It essentially measures the total power generating potential of all renewable power plants that are connected to the grid.

Sen's capability approach: A moral framework that is people-centered, and proposes that the main objective of development is to expand the freedoms that people have (Sen, 1999)

Vulnerability: The conditions determined by physical, social, economic, and environmental factors or processes that increase the susceptibility of an individual, a community, assets or systems to the impacts of hazards and shocks.

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1.

Governing From The Future - Leading With Inclusion

Lorraine E.M. Tromp

1.1 Introduction

'Leading inclusive resilience' is a short sentence that carries much weight. It calls upon us to take the initiative in action while leaving no one behind and equipping everyone with the ability to withstand or recover swiftly from adversity.

Whether they stem from our human nature (e.g., illnesses, crimes), the environment in which we exist (e.g., natural disasters), or the society that we take part in (economic recessions), many are the risks we are subject to every day. These risks may stem from so-called *Black Swans*[1] (Taleb, 2008), which are rare, unpredictable events that have a considerable impact, or *Gray Rhinos*[2]. The latter describes highly probable, high-impact, neglected threats (Wucker, 2017).

The state of being exposed to harm is referred to as 'vulnerability'. The United Nations Development Program (UNDP) defines the term as 'the conditions determined by physical, social, economic, and environmental factors or processes which increase the susceptibility of an individual, a community, assets, or systems to the impacts of hazards' (United Nations Office for Disaster Risk Reduction, 2020). Its counterpart 'Resiliency', in turn, is defined as 'the ability of households, communities and nations to absorb and recover from shocks, while positively adapting and transforming their structures and means for living in the face of long-term stress, change and uncertainty' (Mitchell, 2013). This ability is associated with actions undertaken by policymakers and private economic agents (Briguglio, Cordina, Farrugia & Vella, 2009).

Society has implemented several programs that offer protection against various vulnerabilities. These include cash and in-kind transfers, social insurance, fee waivers, subsidies, training, and public works (Ivaschenko, et al. 2018). Access to social protection has even become a right for all under Article 25 of the Universal Declaration of Human Rights. The latter states, amongst other, that everyone has the right to security in the event of unemployment, sickness, disability, widowhood, old age, or other lack of livelihood in circumstances beyond his control (United Nations General Assembly, 1948).

Moreover, resilience thinking is becoming essential in many areas, such as humanitarian activities, disaster risk reduction, climate change adaptation, social protection, food security and nutrition (Béné, et al. 2016). It is this resilience-driven thinking that this publication applies to a selection of topics, covering the importance of human development and labor markets, the adoption of central bank digital currencies and just energy transitions, as well as why affordable housing is fundamental to inclusive development.

1.2 A vulnerability and resilience framework

In order to improve a country's resilience, it is necessary to have a thorough understanding of its exposure to hazards and its ability to withstand and recover from these. Briguglio (2014) presents a vulnerability-resilience framework mainly targeted at small states. In this framework, he contrasts a country's vulnerability with its coping abilities to assess its risk of being harmed by external shocks (see Figure 1). Figure 1

[1] Black Swans examples: 9/11 (2001), Global Financial Crisis (2007/2008), COVID-19 pandemic (2020).

[2] Gray Rhinos examples: climate change, economic and social inequality, and public sector sustainability.

makes the two risk components evident and shows the negative relationship between resilience and risk. Thus, as resilience is improved, risk is reduced.

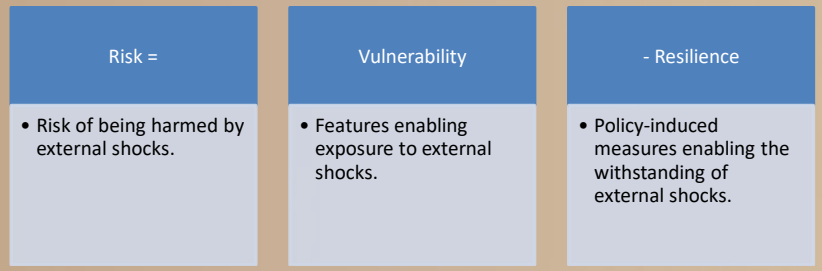

Figure 1: Vulnerability-resilience framework (Briguglio, 2014).

Countries are categorized into four scenarios based on the combination of different degrees of vulnerability and resilience. These are termed 'best-case', 'worst-case', 'self-made', and 'prodigal son' (see Figure 2). 'Best-case' describes countries that adopt resilience-building policies, despite having low vulnerability to external shocks. 'Worst-case' characterizes countries that increase the adverse effects of their high vulnerability because they adopt policies against building resilience. Between these two extremes, 'self-made' and 'prodigal son' are found. The former refers to countries that have a high degree of vulnerability but that also have a high degree of resiliency through the adoption of appropriate policies. The latter, in turn, includes low-vulnerability countries, which adopt policies detrimental to resilience building. Briguglio (2014) classifies countries in one of these scenarios based on a calculated Economic Vulnerability Index (EVI) and Economic Resilience Index (ERI).

According to the available empirical evidence, small states, in particular small island states, display greater vulnerability to external shocks (Briguglio, 2010). These vulnerabilities originate from country features that are inherent and permanent, which include, among others, a high degree of economic openness, dependence on a narrow range of exports, and dependence on strategic imports. Due to the inherent and permanent nature of these features, a country's position on the vulnerability axis is relatively static. It is, however, possible for countries to move across the resiliency axis by adjusting their policies.

For the case of Aruba, a small open economy highly dependent on tourism exports and imports, the theoretical choice is thus between the 'worst-case' and 'self-made' scenarios. Its ultimate position is determined by the policies that are implemented. Is Aruba a country that exacerbates the effects of its natural features or that rises above its vulnerabilities by improving its capacity to cope and recover?

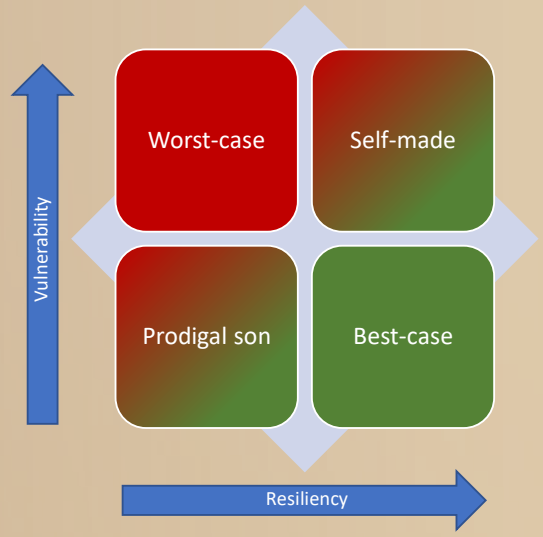

Figure 2: Vulnerability-resilience scenarios (Briguglio, 2014).

Pereira (2018) applied Briguglio's framework to a selection of small open Caribbean economies in order to examine their overall exposure to external shocks and concluded that while Aruba is one of the most vulnerable countries among the selection, it also seems to be one of the most resilient ones. Despite having decreased susceptibility to natural disasters, Aruba's Economic Vulnerability Index (EVI) – which determines its vertical position in the vulnerability-resilience Cartesian plane – is high, given Aruba's degree of trade openness, export concentration, and dependence on strategic imports. Aruba's Economic Resilience Index (ERI) is also high, resulting from Aruba's degree of financial safety and political governance. Pereira (2018) suggests that Aruba's institutions and (political) governance are superior to those of the selected small open Caribbean countries, potentially due to Aruba's status as a constituent country within the Kingdom of the Netherlands. The combination of the EVI and ERI scores mentioned above classifies Aruba as a 'self-made' country. It should be noted, however, that Pereira (2018) focused on monetary and fiscal policy and constructed an ERI reflecting Aruba's macroeconomic stability, market flexibility, and governance. Indicators reflecting social development and environmental management were not considered in the analysis.

1.3 Inclusive resilience in Aruba

This publication discusses resilience in a broader context. It considers resilience in relation to human development (Chapter 2), the future of work (Chapter 3), digital currency and payments (Chapter 4), energy transition (Chapter 5), and affordable housing (Chapter 6).

Furthermore, this publication builds on the first edition of 'Governing from the Future' (Centrale Bank van Aruba, 2021), that applies Futures Thinking to a policy framework for measuring economic wellbeing. In the report mentioned above, the policy-as-usual scenario details a future in which traditional governance and policymaking persist with little adaptation and innovation. Alternatively, the policy reform scenario introduces structural reforms to remediate long-standing institutional failures. While this scenario can be considered a step in the right direction, it is still characterized by market failures and the externalization of costs. The third and last scenario entails a fundamental policy shift in which productivity, innovation, and institutional capabilities are strengthened, and inclusion, healthy social ecologies, and intergenerational equity are fostered.

Following the presentation of these three alternative futures, the focus of this report is on safeguarding a sustainable and inclusive transition toward 2040. In the following chapters, the reader is invited to explore various multidimensional vulnerabilities of Aruba, as well as mechanisms for strengthening social resilience. Enabling the design of a roadmap for the future, the respective authors provide concrete recommendations that policymakers can directly act upon to position Aruba as 'self-made' instead of 'worst-case', across all policy areas (see Table 1).

	SDG	Risk	Vulnerability	Resiliency
The future of work		• Low economic growth. • Lack of social protection.	• Presence and size of an informal economy. • Stagnant labor productivity. • Sluggish participation rate of tertiary education.	• Flexibilization of education. • Improving affordability of education. • Increasing awareness about the importance education. • Implementing programs to foster digital skills. • Improving the quality of internet services. • Providing 21st-century employee and digital skills training. • Prioritizing the adoption of new digital technologies.
Retail digital florin for inclusive resilience: A case study for Aruba.		• Low economic growth. • Financial exclusion. • Money laundering and terrorist financing.	• Constrained innovation capacity. • High costs of doing business. • Shallow financial markets.	• Transitioning the unbanked to the banked. • Fostering competition in payments.
Achieving an inclusive energy transition in Aruba.		• Unsustainable economic growth. • Inequality. • Substantial foreign exchange outflows. • Energy poverty.	• High dependency on fossil fuel. • Price disruptions in the international oil markets. • Lack of investments in sustainable power generation. • Lack of physical space for renewable energy infrastructure.	• Stimulating and de-risking private investment in clean energy sectors. • Introducing a carbon tax with revenue recycling. • Pursuing active labor market policies.
The relationship between human development and economic growth: Moving towards inclusive growth.		• Sub-standard level of wellbeing. • Low/ unsustainable economic growth. • Inequality. • Brain drain.	• Sluggish participation rate of education. • High dependency on one economic pillar. • Mismatch between labor demand and labor supply. • Rigid regulations.	• Investing in teacher resources and teacher density. • Implementation of tutoring programs. • Pursuing active labor market policies. • Modernization of the labor department. • Introduction of a labor immigration policy. • Enhancing labor market flexibility. • Reducing the cost of doing business.

				• Removing unnecessary red tape. • Diversification of the economy. • Attracting foreign direct investment into more knowledge-based industries.
Affordable housing for inclusive development: An exploratory study of housing affordability in Aruba.	  	• Unsustainable/ lack of inclusive development. • Sub-standard level of socioeconomic wellbeing. • Inequality. • Social exclusion. • Housing poverty.	• Accelerated urbanization and 'Airbnbization'. • Insufficient (residential) construction. • Scarcity of land. • Sluggish household income growth. • Inaccessible housing finance.	• Expanding the supply of social housing. • Bolstering the transition to energy-efficient housing construction. • Reassessing and recalibrating the spatial development plan and directives (i.e., the ROPV). • Updating and designing new ROPV. • Enforcing (pre-existing) spatial development regulation. • Increasing labor productivity. • Closing the income gap between the minimum wage and the subsistence level in the short term. • Strengthening educational opportunities and attainment levels, as well as workforce professionalization. • Limiting and controlling low-skilled labor immigration and strengthening integration into the formal labor force.
				• Establishing an inclusive vacation rental platform. • Introducing a fee for supporting social housing and community programs. • Enforcing business and regional zoning licensing related to vacation home rentals. • Limiting the number of licenses for vacation home rentals. • Improving and strengthening tax revenue and collection compliance. • Increasing the transfer tax and special stay tax for non-residents as well as the property tax. • Establishing an affordable housing trust fund, as well as an Aruba housing authority. • Introducing and formalizing borrower-based macroprudential measures for monetary and non-monetary institutions.

Table 1: Report themes applied to Briguglio's vulnerability-resilience framework.

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2.

The Relationship between Human Development and Economic Growth: Moving toward Inclusive Growth

Daniella van den Berg

Abstract

Based on Sen's capabilities approach, the United Nations Development Programme's (UNDP) Human Development Index (HDI) is commonly used to measure development beyond income alone and includes indicators for other social aspects such as health and education. In this paper, the author estimates the HDI for Aruba based on Human Development Report Outlook (HDRO) Technical Notes and explores the directional relationship between human development (HD) and economic growth (EG). The author uses a vector autoregression (VAR) model and Granger causality test to establish the relationship in the context of Aruba. Findings indicate a strong unidirectional flow from HD to EG, but not the other way around. This signifies that the EG experienced by Aruba has not been inclusive. In addition, the author provide insights into the possible reasons for the results. Although this relationship was found to be unstable over the period of study and HDI does not capture all aspects of well-being, the results are important for their implications for Aruban development policies and stakeholders interested in achieving sustainable and inclusive growth and development in Small Island Developing States (SIDS). They imply that a focus on HD is essential to achieving sustained inclusive growth (IG) in the future.

1. Introduction

Over the last decades, development economics has shifted its focus from measuring the development of countries based on economic indicators alone and toward a more comprehensive approach that considers human capabilities. The inclusive approach is based on Sen's (1999) belief that economic, social, and political considerations are important in development. Sen argued that "development can be seen as a process of expanding the real freedoms people enjoy" (Sen, 1999, p. 3). In this view, the development of countries can not only be reduced to a measure of Gross National Product (GNP) or industrialization but social arrangements and political and civil rights are important aspects when considering freedom (Sen, 1999).

The United Nations Development Programme's (UNDP) Human Development Index (HDI), which is based on Sen's capabilities approach, is a summary composite index comprising the dimensions of health, education, and standard of living (HDRO, 2020, 2020).

The relationship between human development (HD) and economic growth (EG) is important to examine because while both are used in measuring how countries' economies compare, the concepts emphasize different aspects of economies. EG refers to quantitative measures of the economy, including those commonly used like Gross Domestic Product (GDP) and Gross National Income (GNI). At the same time, development, in general, more widely incorporates structural societal factors (Meyer et al., 2017). This study examines this relationship in the context of Aruba as a country connected to the Small Island Developing States (SIDS), a distinctive group recognized by the UNDP.

SIDS exhibit characteristics that include smallness, openness to trade, seclusion, and the recurrence of natural disasters, putting them in an economically disadvantageous position (Briguglio, 1995). The case of Aruba is peculiar due to its non-autonomous status within the Kingdom of the Netherlands. The status is additionally important as it is the main reason Aruba is not included in the Human Development Index (HDI) calculations.

Therefore, the purpose of this study is twofold: to estimate HDI for Aruba and to examine the relationship between HD and EG. First, the UNDP does not include Aruba in its HDI calculations. This estimation contributes to our knowledge of HD on the Caribbean islands by calculating the HDI for Aruba. Furthermore, studying the effects of HD and EG on each other in the context of Aruba expands the external validity of this relationship to the distinctive group of countries widely recognized as SIDS.

In this paper, time-series data are used to analyze the relationship between HD and EG in the context of Aruba. To determine the connection between the two, the author uses a VAR model and conducts tests for stationarity and Granger causality. Results show that HD increases EG; however, the opposite is not necessarily the case. In section 5, the author describes potential explanations for the findings and policy recommendations based on the challenges.

Based on GDP per capita alone, Aruba is a high-income country with a GDP per capita in 2018 of $30,253. It ranks among the highest in the Caribbean and Latin America. The GDP per capita in 2018 is a near 500 percent increase from 1986 when the GDP per capita was $6,472. Additionally, Aruba inherited institutions from the Dutch that are still in place today, including educational and judicial systems. Provided the features mentioned above, the Aruban people's living standards should compare to those of highly developed countries. However, the EG enjoyed in the last 30 years has not contributed to a significantly higher standard of living as evidenced by HD indicators. This study covers the current state of the connection between HD and EG and the areas in which further development could move Aruba in the direction of *inclusive growth (IG)* – that is, EG that serves everyone.

The rest of this chapter is organized as follows. Section 2 describes the contextual setting, theoretical framework, and literature on the relationship between HD and EG. Section 3 introduces the data, while section 4 details the methodology used. Section 5 explains the results, and section 6 discusses the limitations and policy implications. Section 7 offers several conclusions.

2. Background, theory, and the relationship between human development and economic growth

2.1. Background

2.1.1 Economy of Aruba

Up to 1985, the primary source of revenue for the Aruban economy was oil. The Lago Oil & Transport Company, Ltd., was responsible for about 25 percent of GDP (Vanegas, Sr & Croes, 2000). In 1985, when the oil refinery shut its doors, between 30 and 40 percent of the labor force (Ridderstaat, 2007) was suddenly out of a job and the government needed to find a solution quickly. Considering the challenges of being a small island state, Aruba took advantage of its naturally endowed beaches and warm weather and directed most of its efforts toward tourism. The EG enjoyed thereafter was evident, with the number of hotel rooms more than tripling from 1986 to 2011 while the number of visitors increased by nearly five times during the same period (Ridderstaat et al., 2014). In 2019, the World Travel & Tourism Council estimated that more than 66 percent of Aruba's GDP and 85 percent of jobs on the island were attributable to the tourism industry (Aruba 2021 Annual Research: Key Highlights, 2021).

However, with this new source of income also came increased vulnerability to external shocks. Considering that in 2019, 70 percent of visitors to the island were from the United States

(US) and that the Aruban florin is pegged to the dollar, Aruba is especially susceptible to shocks affecting the US economy (Aruba 2021 Annual Research: Key Highlights, 2021; The Aruban Florin, n.d.). This vulnerability is clear in Figure 1.

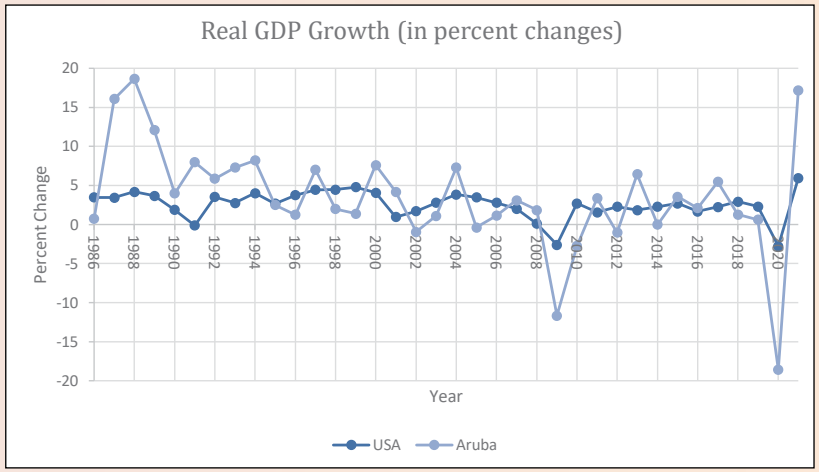

Figure 1 : Real GDP Growth rates in annual % change for Aruba and USA from 1986 to 2021. Created by the author based on CBA and World Development Indicators (WDI) data.

In the 30 years since the tourism industry became the dominant economic force on the island, EG has turned negative five times: in 2002 due to the consequences of the September 11, 2001, attack on the World Trade Center in New York City; in 2005 due to the disappearance of an American teenager on the island; in 2009 and 2010 due to the global financial crisis; in 2012 due to the closure of the Valero refinery; and most recently in 2020 as a result of the COVID-19 pandemic. However, the Aruban economy has been quick to regain (positive) growth in the years following each of these events.

As can be seen in Figure 1, COVID-19 had a devastating impact on Aruban economy, possibly the worst crisis faced by the Aruban government since the closure of Lago in 1985. As a member of the Dutch Kingdom, the Aruban government negotiated several short-term loans for a total Afl. 918 million (US$ 510 million) from the Netherlands when the country's borders were temporarily closed. These loans, accompanied by severe conditionality, require several reforms to be implemented, including to the tax, education, and healthcare systems (Fitch Affirms Aruba at "BB"; Outlook Stable, 2022). There is no doubt that this will affect HD in the future. Whether this impact will be positive or negative remains to be seen.

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Population	85,450	87,280	89,009	90,866	92,892	94,992	97,016	98,744	100,028	100,830	101,226	101,362
Unemployment (%)	-	-	3.3	4.8	6.5	8.1	11.4	9.5	8.8	9.3	7.1	6.9
Inflation (annual %)	3.0	1.9	2.3	4.0	2.9	3.3	3.7	2.5	3.4	3.6	6.0	9.0
Education Expenditure (% of GDP)	-	4.76	4.40	4.71	4.74	4.92	-	4.41	4.68	-	4.82	5.00
Export	6,030,942	7,073,995	8,520,550	5,264,571	2,835,652	2,914,189	2,416,307	4,239,026	4,329,441	4,088,518	3,865,578	3,589,476
Import	12,542,830	14,880,380	32,452,190	43,377,290	43,152,230	35,473,540	36,524,430	28,133,390	22,380,04	22,339,72	21,616,05	24,326,23
GINI Index	-	-	-	0.40	-	-	-	-	-	0.41	-	-

Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Population	101,452	101,665	102,050	102,565	103,165	103,776	104,339	104,865	105,361	105,846	106,310	106,766
Unemployment (%)	10.3	10.6	8.9	9.6	7.6	7.5	7.3	7.7	8.9	7.3	5.2	8.6
Inflation (annual %)	-2.1	2.1	4.4	0.6	-2.4	0.4	0.5	-0.9	-0.5	3.6	3.9	-1.3
Education Expenditure (% of GDP)	5.92	6.93	6.12	6.55	6.44	5.85	5.89	5.49	-	-	-	-
Export	4,005,811	3,326,649	3,878,494	3,411,325	3,930,55	5,542,623	6,011,083	5,580,567	6,011,083	5,875,014	5,104,383	3,807,579
Import	18,746,47	16,208,88	23,131,96	16,289,47	14,769,49	13,777,6	13,057,73	12,261,42	12,212,46	13,235,86	13,378,55	12,021,61
GINI Index	-	0.44	-	-	-	-	-	0.41	-	-	0.44	-

Table 1: Aruban Economic Indicators. Created by the author based on World Development Indicators, Centrale Bank of Aruba, and Central Bureau of Statistics data.

Economic indicators in Table 1 show that Aruba has typical characteristics of the SIDS community, such as small population size and a large trade deficit in addition to economic volatility. Furthermore, what stands out are education expenditures as a percentage of GDP. These figures are above average for the Latin American and Caribbean (LAC) region and, since 2006, also above average for higher-income countries according to the World Development Indicators. A look at HDI later in this chapter will show that education outcomes do not compare to those of high-income countries. This disconnect will be further explored in section 5.

Figure 2 compares Aruba in terms of HD to countries in the region, namely in the LAC, and others with similar characteristics, namely SIDS. Overall, the island ranks third among Caribbean islands after the Bahamas and Barbados, sixth among SIDS behind Singapore, Bahrain, Palau, and Mauritius, and eighth among LAC countries behind highly developed Chile, Argentina, and Panama.

Figure 2: Human Development in Latin America and the Caribbean (LAC) and Small Island Developing States (SIDS).
Created by the author, based on UNDP Human Development Report Data. Map classification based on 2014-2017 HDI averages.

2.1.2 Small Island Developing States

The United Nations (UN) recognizes Small Island Developing States (SIDS) as a distinctive group of countries (member and non-member states) with unique social, economic, and environmental characteristics. This community comprises less than 1 percent of the world's population (UN). Briguglio (1995) outlined the characteristics of SIDS that inhibit their abilities to grow economically, including those associated with small size, remoteness and insularity, openness to and reliance on foreign markets, and vulnerability to environmental factors (Briguglio, 1995; Pereira & Steenge, 2021).

The size of small island states is at the root of many additional challenges, including the limited resources that force countries not only to focus their efforts on a few (in many cases one or two) economic pillars but also to rely heavily on foreign markets for basic goods (Mr. Elcior Santana et al., 2002). In turn, being small affects domestic markets due to being predominantly price takers. A limited capacity to make use of economies of scale means that citizens have few domestic competitors and are highly dependent on a few foreign markets for the export of goods and services (Alesina & Spolaore, 1997; Briguglio, 1995; Easterly & Kraay, 2000; Escaith, 2001). These characteristics, and the openness, are responsible for the vulnerability of these small economies to economic shocks in the external global environment (Armstrong & Read, 2003; Srinivasan, 1986).

Despite the challenges, many studies have shown that small island states are not necessarily worse off economically and have been able to provide a "high standard of living for their citizens" (Easterly & Kraay, 2000; Escaith, 2001).

2.2 Theory

2.2.1 Growth Theory

While theories on growth have emerged throughout the years, the focus on EG has not changed dramatically. What has changed throughout the years, and thus also throughout the theories, are the key drivers of growth. Before the 1980s, EG was defined by classical and neoclassical growth theories. While classical theory indicated that EG would slow due to population growth and limited resources, the neoclassical growth theory focused on three economic forces - physical capital, labor, and technology – while theorizing that these forces would result in a steady EG (Eltis, 2000; Solow, 1999).

However, during the 1980s, empirical and theoretical evidence led to the emergence of endogenous growth theory. This theory suggests that EG is derived from forces within the economic system, endogenous forces, and not those exerting an external impact (Briguglio, 1995). The focus is on the driving forces behind growth: technology, human capital, and increasing returns (Martin & Sunley, 1998). In 'The Origins of Endogenous Growth', Romer discussed evidence that economists had "long taken for granted", including the idea that technological advances are a result of what people do (1994, p. 12). In essence, the idea is that incentivizing human capital at the aggregate level increases returns and governmental policies to stimulate innovation in technological products and processes.

2.2.2 Capabilities Approach and Inclusive Growth

In his 1999 book, Development as Freedom, Sen explained the capabilities approach. Beyond GDP per capita, development should be measured by factors that expand the freedoms of citizens in a country. Economic freedom, thus income, is a "means" to achieving freedoms that members of society would like to possess. Beyond economic indicators, Sen argued that

social and economic arrangements, including the right to a decent education and to healthcare allowing citizens to live a long and healthy life, are important. Moreover, political freedom and civil rights are crucial in allowing citizens of a country to live peaceful lives (Sen, 2014).

While Sen was one of the first to explore the idea of an all-encompassing measure of development and keyed the term "capabilities approach", others have continued to develop the idea of measuring economic well-being, development, and prosperity beyond its economic component alone. One of the newer terms, inclusive growth, has become an increasingly researched topic with the rise of inequality throughout the world. The OECD definition outlines fair distribution of EG across society and opportunities being created for all as essential components of inclusive growth (OECD Publishing, 2018). Similarly, the World Economic Forum released a report on inclusive growth and development (2017) that includes a reflection on the limitations of GDP as the metric for measuring a country's development and a realization of the need for a more "socially-inclusive" approach to generate EG (Samans et al., 2017). In this chapter, the social and economic arrangements of development are scrutinized, with health, education, and economic indicators making up the HDI.

2.3 Relationship between economic growth and human development

2.3.1 Relationship between Human Development and Economic Growth

Furthermore, HD goes beyond an "income-oriented approach" and adopts a human-centered approach where social issues are considered alongside economic data (UNDP, 2016). Studies on the relationship between EG and HD have also found a bidirectional positive relationship in developing countries (Ranis et al., 2000). Ranis et al. (2000) provided details on how each of the two relationships affects the other. From EG to HD, the resources obtained, especially capital, can be invested in areas such as education and healthcare, while from HD to EG, the increased educational capabilities and health of the population can be a driver for EG.

2.3.2 Human Development and Economic Growth in Caribbean Context

HD as a measure of development is relatively new in the Aruban context. Although there are studies for Aruba, including quality of life and Sen's approach, HDI has not been used in studies of Aruba as yet (Ridderstaat et al., 2016; Taylor, 2021).

The literature on EG in Aruba has been mainly dominated by its relation to tourism (Peterson et al., 2020; Ridderstaat et al., 2014, 2016; Taylor, 2021; Vanegas Sr. & Croes, 2003). This is not surprising in light of the portion of the economy directly impacted by the tourism industry. In one of these studies Ridderstaat et al. (2014) took on the directional relationship between tourism development (TD) and EG. The empirical method included cointegration analysis and Granger causality testing to identify a bilateral relationship between TD and EG.

2.3.3 Country Studies

In the literature on HD and EG, many studies have examined the relationship between these two development measures in a cross-country setting. Nevertheless, most are focused on developing countries, while Sen (1999) argued that development analysis is important even for more affluent countries. Rich countries in which subgroups are not developed at the same rate

as others can provide critical insights into our understanding of development and underdevelopment (Sen, 1999).

Ranis et al. (2000) used panel data to examine the "causal chains" between HD and EG in developing countries. They explored the key factors responsible for the link and found both chains (from EG to HD and vice versa) to have significant positive effects. Furthermore, in Chain A (from EG to HD), important features included social expenditures, adult literacy rates, and female education enrollment. In contrast, for Chain B, these factors were the investment rate and equality of income distribution (Ranis et al., 2000).

Other research on HD and EG together also concluded that HD is a key feature in inducing EG (Mayer-Foulkes, 2003; Sala-i-Martın, 2005; Suri et al., 2011). Furthermore, there are studies on this specific relationship for India, Norway, Zambia, and Nigeria (Abraham & Ahmed, 2011; Chikalipah & Makina, 2019; Ghosh, 2006; Öztürk & Suluk, 2020). So, in addition to HD not having been studied for Aruba, neither has the relationship between HD and EG.

Based on previous studies on the relationship between EG and HD, the following hypotheses are tested:

I. HD affects EG positively
II. EG affects HD positively

3. Data

Since the HDI for Aruba has not been calculated, for this study HDI was calculated for 21 years, from 1997 to 2017[1]. The index ranges from 0 to 1 and is composed of three equally weighted dimensions: health, education, and standard of living. The dimension index for each was calculated, and the dimensions hold equivalent weight; thus, the HDI is the average of the dimension indices (HDRO, 2020, 2020).

Since 1990, while the dimensions that make up HDI and indices calculations remained the same, the indicators used for the education index and standard of living have been altered. From 1990 to 2009, the education index was measured using Adult Literacy Rate[2] and Gross Enrollment Ratio[3]. See Figure 3. The education index comprised two-thirds Adult Literacy Rate and one-third Gross Enrollment Ratio. Additionally, before 2010, living standards were measured by GDP per capita.

After 2009, the education indicators were replaced by Expected Years

[1] These calculations are based on assumptions outlined in Table 2

[2] The adult literacy rate encompasses the percentage of people above 15 years of age who are able to read and write short passages about their daily life (World Development Indicators database, World Bank).

[3] The gross enrollment ratio includes the total number of students in primary and secondary school of the official age group for a given level of education, as a percentage of the school-age population (UNESCO UIS).

[4] Expected years of schooling is the amount of years a school entering child is expected to spend in school, including repetition years (Gender Statistics database, World Bank).

[5] The mean years of schooling reflects the average number of completed years of education of the 25 years and older population of a country, and excludes years spent repeating grades (UNESCO UIS).

of Schooling[4] and Mean Years of Schooling[5]. Furthermore, the GDP index indicator has been replaced with GNI per capita with fixed 2017 prices. See Figure 4. In both instances, the natural logarithm of the actual, minimum, and maximum standard of living is used.

In addition to education and standard of living, the health dimension also uses indicators, specifically the life expectancy measured in years. This HDI calculation aligns with the UNDP technical notes for the index on all the countries calculated. To maintain uniformity across dimensions, the indices are calculated using Formula 1 and following guidelines in Table 2. The results for each index are compiled in Table 3.

$$Dimension\ index = \frac{actual\ value - minimum\ value}{maximum\ value - minimum\ value} \qquad (1)$$

Formula 1: Calculation for Dimension Indices of HDI.

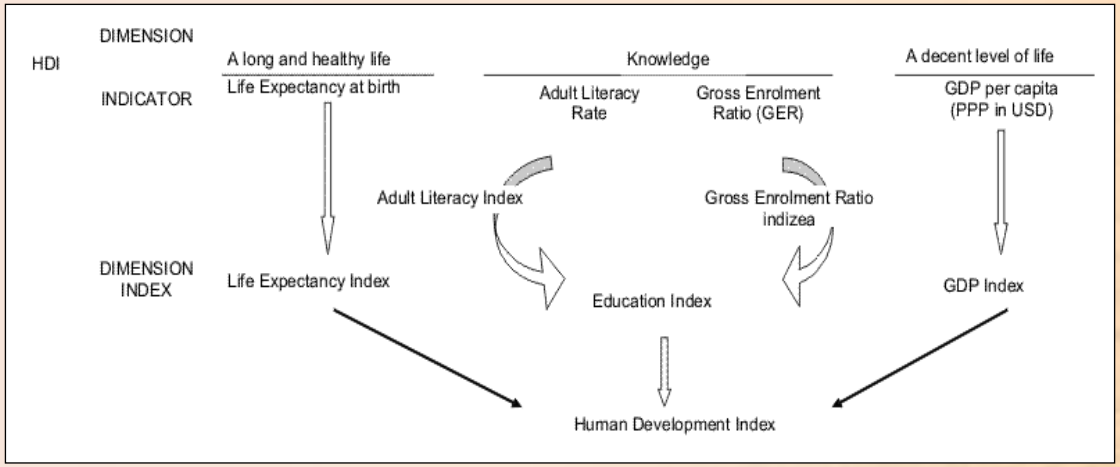

Figure 3: Human Development Index (HDI) dimensions and indicators from 1990 to 2009. Source: Eustat Basque Institute for Statistics

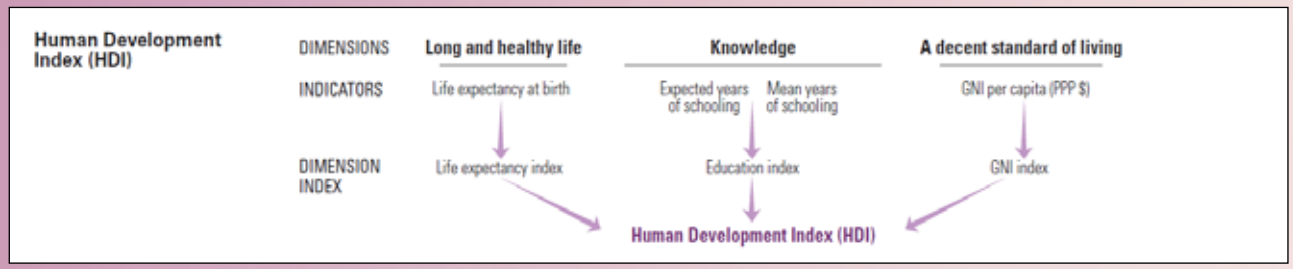

Figure 4: Human Development Index (HDI) dimensions and indicators from 2010 to the present.
Source: Human Development Report Outlook (HDRO) Technical Notes

		1990-2009		2010-Present	
Dimension	**Indicator**	**Minimum**	**Maximum**	**Minimum**	**Maximum**
Health	Life expectancy (years)	25	85	20	85
Education	Adult literacy rate (percentage)	0	100	NA	NA
	Combined gross enrollment rate (percentage)	0	100	NA	NA
	Expected years of schooling (years)	NA	NA	0	18
	Mean years of schooling (years)	NA	NA	0	15
Standards of Living	GDP per capita (PPP$)	100	40,000	NA	NA
	GNI per capita (2017 PPP$)	NA	NA	100	75,000

Table 2: Human Development Report Guidelines for Human Development Indicator (HDI) calculation. Created by the author based on Human Development Report Outlook (HDRO) Technical Notes and Eustat Basque Institute for Statistics

As data for smaller island states are not easily available, the dataset was compiled from various sources. The two main variables are HDI as a proxy for HD, and GDP growth for EG. For missing data, an average of the before and after years, or previous year data, was used. Table 4's 'Notes' column indicates whether averages or previous year data were used, along with all data sources.

Year	Life Expectancy	Expected Years of Schooling	Mean Years of Schooling	Education Indicator	GNI per capita	
2010	0,846	0,749	0,558	0,653	0,865	**0,782**
2011	0,849	0,737	0,558	0,647	0,867	**0,781**
2012	0,851	0,761	0,558	0,659	0,871	**0,788**
2013	0,853	0,745	0,558	0,651	0,883	**0,789**
2014	0,855	0,729	0,558	0,643	0,887	**0,787**
2015	0,857	0,728	0,558	0,643	0,888	**0,788**
2016	0,860	0,761	0,558	0,659	0,889	**0,795**
2017	0,862	0,761	0,558	0,659	0,892	**0,797**

	Dimension Health	Education		Standard of living	HDI	
Year	Life Expectancy	Adult Literacy Rate	Gross Enrollment Ratio (GER)[6]	Education Dimension indicator	GDP per capita	
1997	0,811	0,973	1,064	1,003	0,866	**0,893**
1998	0,812	0,973	1,064	1,003	0,876	**0,897**
1999	0,812	0,973	1,064	1,003	0,879	**0,898**
2000	0,813	0,973	1,046	0,997	0,889	**0,900**
2001	0,814	0,971	1,045	0,995	0,890	**0,900**
2002	0,816	0,971	1,065	1,002	0,888	**0,902**
2003	0,817	0,971	1,048	0,996	0,891	**0,902**
2004	0,819	0,971	1,049	0,997	0,904	**0,907**
2005	0,821	0,971	1,045	0,995	0,910	**0,909**
2006	0,824	0,971	1,065	1,002	0,915	**0,914**
2007	0,826	0,971	1,094	1,012	0,927	**0,922**
2008	0,829	0,971	1,045	0,995	0,935	**0,920**
2009	0,831	0,971	1,058	1,000	0,919	**0,917**

Table 3: Human Development Index (HDI) pre-and post-2009 calculations for Aruba. Made by author based on Eustat Basque Institute for Statistics and Human Development Report Outlook (HDRO) Technical Notes

Table 3a shows the post-2009 method retroactively for the years 1997 to 2009. The reasoning is twofold. First, the new method is more representative of Aruba's situation than the pre-2010 method shown in Table 3. Additionally, the change in method from 2009 to 2010 led to a drastic decrease in HDI calculation, i.e. from above 0.90 to below 0.78, which could cause a false correlation between the 2009 crisis and lower HD levels.

[6] According to UNESCO, GER can exceed 100% due to the inclusion of over-aged and under-aged pupils, early and late entrants, and grade repetition.

The reasons for changes in the calculation method were outlined by the UN Statistics Division in 2011. In general, these changes result from yearly data and historical revisions performed by the UNDP Human Development Report Office and are based on more accurate knowledge of better measurements. For this reason, the periods for which different methods were used should not be compared to each other (Frequently Asked Questions (FAQs) about the Human Development Index (HDI), 2011).

As for EG, GDP growth in percentages is used as the measurement from 1997 to 2017. GDP growth is measured as growth on top of the previous year on an annual basis. The data stem from the World Bank's World Development Indicators (WDI) database.

	Dimension Health	Education			Standard of living	HDI
Year	Life Expectancy	Expected Years of Schooling	Mean Years of Schooling	Education Dimension	GNI per capita	
1997	0,826	0,740	0,574	0,657	0,855	**0,774**
1998	0,826	0,740	0,574	0,657	0,859	**0,775**
1999	0,827	0,740	0,574	0,657	0,856	**0,775**
2000	0,827	0,731	0,574	0,652	0,870	**0,777**
2001	0,829	0,726	0,566	0,646	0,862	**0,773**
2002	0,830	0,732	0,566	0,649	0,850	**0,771**
2003	0,831	0,723	0,566	0,645	0,859	**0,772**
2004	0,833	0,722	0,566	0,644	0,871	**0,776**
2005	0,835	0,731	0,566	0,649	0,846	**0,771**
2006	0,837	0,744	0,566	0,655	0,879	**0,784**
2007	0,840	0,769	0,566	0,668	0,868	**0,786**
2008	0,842	0,743	0,566	0,654	0,888	**0,788**
2009	0,844	0,752	0,566	0,659	0,873	**0,786**

Table 3a. Human Development Index (HDI) calculation for 1997-2009. The neaw post-2009 method going backwards is applied to the pre-2009 years.

Variables						
Human Development (HDI)	**Dimensions**	**Indicators**	**Data Source**	**Institution**	**Years**	**Notes**
	Health	Life Expectancy	World Development Indicators database	World Bank	1997 - 2017	
	Education	Adult Literacy Rate	Gender Statistics database	World Bank	2000, 2010, 2018	Part of the pre-2010 method; For pre-2000 years, the data for 2000 are used; between 2000 and 2010, the average of these two years is used.
		Gross Enrollment Ratio	Institute for Statistics	UNESCO	1999-2009	Part of pre-2010 method; For primary and secondary school; Pre 1999, 1999 data used and post 2012, 2012 data used
		Expected Years of Schooling	Gender Statistics database	World Bank	1999-2012	As part of the post-2009 method; Missing data for 2013 and 2017 are replaced with the average of prior and after data.
			Global Innovation Index database	Global Innovation Index	2014-2016	
		Mean Years of Schooling	Institute for Statistics	UNESCO	2000, 2010	Part of post-2009 method; Pre 2000, 2000 data used; Average of 2000 and 2010 data used for 2001-2009; Post 2010, 2010 data used
	Living Standards	Gross Domestic Product per Capita	World Development Indicators database	World Bank	1997-2017	Fixed prices of 2017 used as the base
		Gross National Income per Capita	World Development Indicators database	World Bank	1997-2017	Fixed prices of 2017 used as the base
Economic Growth (GDP growth in %)			World Development Indicators database	World Bank	1997-2017	

Table 4: Compilation of variables, including HDI dimension indicators and data sources. Created by the author.

Table 4 shows the sources for each of the dimension indices that make up HDI for variable GDP growth. It also highlights the institutions that collected these data and years available, and shows how missing variables are accounted for or considered.

4. Methodology

Previous studies have demonstrated that HD and EG are correlated and the ways in which this occurs (Ranis et al., 2000; Ranis & Stewart, 2007; Suri et al., 2011). The methodology used in this study involved econometric models - more specifically, multivariate time-series regressions, a reduced form bivariate Vector Auto-Regressive (VAR) Model and Granger Causality test. Data for two (2) time-dependent variables and their lags were used to analyze their sequential relationship.

The VAR model is a system of equations that can capture dynamic relationships between macroeconomic variables. It does so by relating current observations of a variable with lagged observations of the same variables and the lagged variables of other variables in the system (Giannone et al., 2015). It has been used in macroeconomic research since the 1980s and is ideal for this study as it allows for feedback between variables (Stock & Watson, 2001). The feedback in question here is how EG affects HD and, in turn, how HD affects EG.

Additionally, the Granger causality test helps to determine whether a variable in the equation can predict another variable. If one variable does not Granger cause another variable, then the lagged value of one variable cannot forecast the explanation of the other variables.

Since this study used time-series regressions, some of the main concerns with time series data, including stationarity, cointegration, and endogeneity, needed to be addressed. A series of tests were carried out to determine whether to take additional econometric measures to ensure robust results.

Finally, to confirm this relationship, the Granger causality test was conducted to determine the direction between the two main variables of interest (Granger, 1988; Ridderstaat et al., 2014). With the data available for Aruba in this study, the author finds a unidirectional Granger causality. A more in-depth analysis of the results is described in section 5.

5. Results

5.1 Preliminary cross-sectional analysis
Some preliminary correlations were established before conducting the tests and carrying out the VAR model. Table 5 demonstrates these correlations, which are based on work by Suri, Ranis and Stewart in exploring the linkages between EG and HD (Suri et al., 2011). The data limitation allowed this study to focus on two main known channels that flow between EG and HD.

VARIABLES	(1) HDI	(2) HDI	(3) GDP growth	(4) GDP growth
GDP growth	0.000307	0.000240		
	(0.000348)	(0.000486)		
govt exp on education	0.000894***	0.000667		
	(0.000240)	(0.000480)		
lag1 govt exp on education		-6.07e-05		
		(0.000566)		
lag2 govt exp on education		0.000325		
		(0.000521)		
HDI			-36.64	59.68
			(128.0)	(114.8)
FDI			0.00864	0.0674
			(0.0888)	(0.0812)
lag1FDI				0.182**
				(0.0805)
lag2FDI				0.188**
				(0.0792)
Constant	0.771***	0.772***	29.93	-46.93
	(0.00314)	(0.00334)	(100.1)	(89.88)
Observations	21	19	21	19
R-squared	0.438	0.481	0.006	0.384

Table 5: Results of preliminary cross-sectional analysis. Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

On the one hand, flowing from EG to HD are government social expenditures for which government expenditure on education was used as a % of GDP. This variable was chosen due to the availability of data and because this is the least developed dimension of HD on the island. The result indicates that a 1 percent increase in government expenditure (as a % of GDP) on education increases HDI by 0.00089, all other things constant. This result is significant at the 1 percent significance level.

On the other hand, foreign direct investment (FDI) (as a % of GDP) does not affect GDP growth in the same year, but the positive results are significant after one and two years, respectively. For a one-year lag, a 1 percent increase in FDI (as a % of GDP) increases GDP growth by 0.182 percent, all else constant. For two years, this number increases to 0.188 percent of GDP growth, all else constant.

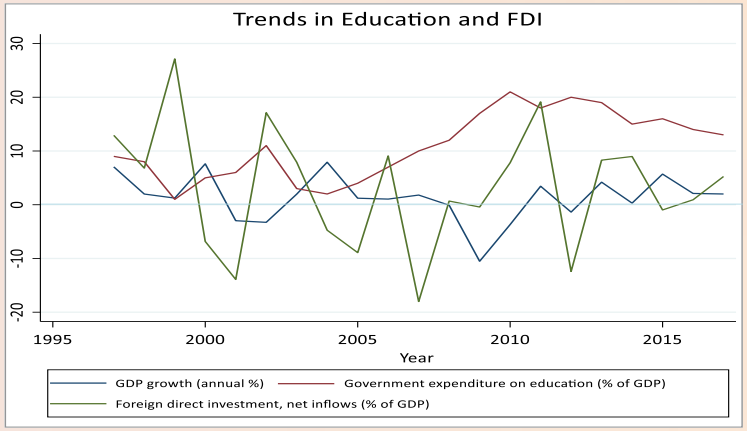

Figure 5: Trends in GDP growth alongside expenditure in education and foreign direct investment. Created by the author based on World Development Indicator data.

5.2 Main results

	(1)	(2)
VARIABLES	GDP growth	HDI
1st Lag GDP growth	-2.045***	0.00896
	(0.0606)	(0.00587)
2nd Lag GDP growth	-3.150***	0.0175*
	(0.106)	(0.0103)
1st Lag HDI	351.9***	-2.824**
	(13.93)	(1.350)
2nd Lag HDI	1,191***	-7.642*
	(43.94)	(4.258)
Constant	3.119***	-0.00421
	(0.0697)	(0.00675)
Observations	7	7

Table 6: VAR model results with two lags. Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 6 shows the results for the main regression model of this research. The VAR model determines the long-run relationship between the logged transformation of GDP growth and the differenced logged transformation of HDI. An exploration of these results shows that the first and second lags of HDI greatly and positively affect GDP growth. These results are also significant at the 1 percent confidence level. In the Aruban context, this is consistent with characteristics of SIDS and a reminder of the volatility of the SIDS economies. On the other hand, only the second lag of GDP growth is significant at the 10 percent confidence level for HDI; this effect is only marginally positive. In other words, increasing GDP growth two years ago will only slightly increase HDI in the contemporaneous year.

As a main takeaway from Table 6, HDI positively and significantly affects GDP growth but not the other way around. In the next section, I offer possible reasons for this long-run, mostly unidirectional, relationship, and some implications for policy. After conducting the VAR analysis, I conducted a Granger Causality test to determine if GDP growth and HDI Granger cause each other.

Table 7 shows that HDI does Granger cause GDP growth. However, GDP growth does not Granger cause HDI. This result requires further discussion and investigation.

Equation	Excluded	chi2	df	Prob>Chi2
GDP growth	HDI	781.420	2	0.000
GDP growth	ALL	781.420	2	0.000
HDI	GDP growth	2.977	2	0.226
HDI	ALL	2.977	2	0.226

Table 7: Granger Causality Wald test for GDP Growth and HDI

6. Discussion and policy recommendations

The results demonstrate that HD has a significant effect on EG but not vice versa. This means that throughout the period of this study (1997-2017), the EG Aruba experienced did not increase the standard of living for the Aruban society as a whole. Considering the results, this finding is critical due to the positive effects of the bidirectional relationship demonstrated by Suri et al. (2011), in which EG provides the resources for further HD, and HD in turn contributes to EG. This consistent feedback loop is important for sustained growth and development (Suri et al., 2011). To achieve sustained inclusive growth, it is important to re-invest growth into the HD of the Aruban community, and target it especially toward disadvantaged and minority communities. As for its position in the existing literature, the results for a one way relationship are similar to those shown for various country studies, even though directions vary (Abraham & Ahmed, 2011; Chikalipah & Makina, 2019; Öztürk & Suluk, 2020).

While a detailed analysis of the reasons for these results is beyond the scope of this study, some insights are offered into certain areas that might impact results and policy recommendations for each area. Two of the focus areas - education expenditure and labor market policies - are not only important as standalone spaces with the potential to yield high returns, but together complement each other's development. Therefore, investments in achieving higher participation rates in tertiary education must be coupled with job creation to avoid further emigration of the highly skilled. In particular, the areas covered relate to the low-performing education dimension in HDI and include labor market characteristics and dependency on a service-based economy.

When considering why EG does not translate into HD, it is important to look at the different dimensions of the HD proxy: health, education, and income. In the health and income dimensions, Aruba ranks among high-income countries. Conversely, the education dimension lags behind. Looking at the economic indicators (Table 1) and preliminary results (Table 5), we see that this lag is not due to a lack of expenditures on education but rather, to a disconnect between spending and outcomes. This underperforming dimension is a critical component and should be a focus of policymakers aiming to develop the Aruban population into a highly educated workforce. According to the World Bank, the average return to education for tertiary education is 17 percent compared to 10 percent for primary and 7 percent for secondary education. More specifically, in the LAC region, the total number of students in tertiary education programs has doubled over the past decade. Over their lifetimes, these individuals will earn twice as much as their counterparts with only a high school diploma (Marta Ferreyra et al., 2017). Developing the education component will require increasing participation in tertiary education and decreasing the rate of brain drain.

Since 2006, Aruba's education expenditures (as percentage of GDP) lie at or above levels of the average high-income countries. However, outcomes in terms of level of education achieved are below expectations. This indicates that the move towards inclusive growth should include targeted investment in projects in line with SDG 4 (Quality Education) and thus also with higher return on investment. Currently, a majority of projects focus on physical infrastructure. While children need classrooms, infrastructure does not offer a high return on investment. Research on the education reforms enacted by Sweden in 1990 show that investing in teacher resources and teacher density lead to improved outcomes for children of primary school and secondary school age. Both effects are particularly effective

for children from disadvantaged backgrounds (Bjorklund et al., 2006). Additionally, evidence from 96 randomized evaluations in high-, middle-, and low-income countries showed that tutoring programs led to consistently greater improvements from pre-school to secondary students, especially by teachers or paraprofessionals. The effects of tutoring programs on average brought students from the 50th to 66th percentiles, and the lower the grade, the greater the effects (Dadisman & Garau, 2020).

In addition to this misalignment, the Caribbean region has for many years struggled with challenges associated with brain drain (Docquier et al., 2007; Mishra, 2006). While a modest (5 to 10 percent) rate of skilled migration has been shown to have potential benefit to the sending and receiving countries (Docquier, 2006), according to Mishra (2006), countries in the Caribbean have lost an estimated 10 to 40 percent of their working labor force due to the emigration of their most skilled. If one of these islands' distinctive characteristics is the scarcity of resources, the emigration of skilled workers to developed countries depletes "one of their scarcest resources, human capital" (Docquier, 2006, p. 2). Nevertheless, determinants of emigration, including the size of the country, socio-political situation, level of development and proximity to OECD countries, explain why brain drain is a challenge for the Caribbean region (Docquier, 2006). Even though some of these characteristics cannot be changed, the Caribbean islands must create an environment that is favorable to highly skilled professionals.

Furthermore, for Aruba in particular, aside from infrastructure one of the major outlays in education year after year is 'Arubalening', namely the government student loans program. With the limited number of tertiary education institutions on the island, the government provides student loan programs (at 0 percent interest since 2020) to encourage tertiary education, regardless of household income. Since 2011, the government has also incentivized the return of graduates to the country by forgiving 30 percent (amended to 35 percent in 2017) of total loans upon joining the Aruban labor market within three years of graduation (Wijziging van de Landsverordening, 2017). This is an attempt to improve educational outcomes, reduce brain drain, and stimulate the Aruban economy. However, this has not brought about drastic change in the last ten years.

While policy action encouraging tertiary education (and the return of graduates to Aruba) is important, the outcomes will not fully reap benefits unless labor market reforms are also pursued. The incentive relating to student loans could have been expected to have a positive effect; however, this policy initiative has not mitigated several of the labor market challenges associated with the Caribbean islands. Downes (2006) listed a multitude of structural and institutional features of Caribbean island labor markets, with the most applicable and harmful to the Aruban economy being the mismatch between labor demand and supply and the rigid regulations (also known as "red tape"). The mismatch in supply and demand could be lessened by dedicating a department to active labor market policies, as has been done by Barbados' National Employment Bureau (NEB). In a dedicated department in the Ministry of Labor, the unemployed can register for work, speak to a counselor, and learn about listings that may be of interest or a match for them. Further, this office could also provide information on skills needed for diverse sets of jobs (Carrington, 2017). Akin to Barbados' NEB is the DPL (Departamento pa Progreso Laboral) in Aruba. While the DPL has a dedicated "job-center" and two other sub departments that work with employers needing immigrants for positions, modernization of the department as a whole could

enable pursuit of more active labor market policies. This includes the digitalization of the “job-center” to provide a databank of jobs available on the DPL website and redirection of efforts toward a “skill-center” where job seekers receive CV advice and interview preparation tips. They may also enroll in courses that increase their digital skills. The two current sub-departments may be heavily reduced by introducing and implementing a comprehensive labor immigration policy. Young highly-skilled and educated immigrants can contribute, in addition to filling positions unable to being filled by locals, to social security and healthcare programs, which face solvency challenges in the near future (Tromp, 2021). Or rigid regulations (e.g., limited part-time jobs and inflexible working hours) could be relaxed to make the Aruban economy more conducive to FDI and more accessible to the diverse people inhabiting the island. Enhancing labor market flexibility and reducing the cost of doing business were among the policy recommendations stated in the 2019 IMF report (International Monetary Fund, 2019). These recommendations were based on the finding that current regulations were being used as “job protection mechanisms” that limited the flow of labor, disturbed capital allocation decisions within businesses, and reduced labor market efficiency (Taylor, 2020).

This study’s preliminary results pointed to the positive effects of FDI on EG; however, if it takes too long to open a business account or is too expensive to obtain a license to do business legally, foreign companies will not invest in Aruba. In 2019, the IMF report identified several national ordinances deemed to hinder growth, of which the weightiest were the Establishment of Business and Permits and Licensing. About 70 percent of businesses stated that these ordinances created “unnecessary red tape”(International Monetary Fund, 2019 p. 20). Additionally, a CBA report on the cost of doing business in Aruba found the key challenges to mirror those outlined by the IMF report *(Cost of Doing Business in Aruba, 2019).*

While these suggestions are based on policies implemented by countries in the region or identified in previous research, it is important to acknowledge that, ultimately, it is the efficacy of policy action in the Aruban context that will be crucial to determining if implementing these policies will lead the country toward more inclusive growth.

In addition to brain drain and rigid regulations, the heavy reliance of the Aruban economy on tourism could also explain the low performance of the education dimension in HDI and therefore likewise have an impact on study findings. The tourism industry contributes to more than 80 percent of legal jobs in non-crisis periods without including those in the shadow economy (Aruba 2021 Annual Research: Key Highlights, 2021). The types of jobs that are abundant in hospitality, service-based jobs, usually do not require a tertiary degree. Therefore, residents of Aruba who do not plan on leaving the island might not see the need or benefit of obtaining a costly tertiary degree. The decision to pursue a tertiary degree rather than employment is an opportunity cost in the form of lost wages.

A policy recommendation that could tackle this specific challenge and increase interest in tertiary education involves diversifying the economy by attracting FDI into more knowledge-based industries, such as science, technology, engineering, and mathematics (STEM) specifically with a focus on renewable energy. Aruba has an abundance of sun and wind, and access to ocean waves. While these influence tourism, with the rise of renewable energy, Aruba could become a hub for researchers and companies aiming to develop renewable energy

technologies. Due to the proximity to Latin American, Caribbean, and North American markets, export also may be possible. The University of Aruba inaugurated a STEM department in 2019, but investment must also be directed toward attracting FDIs to create jobs in this field. It would be unwise to allow graduates from this new department to move abroad to find jobs and further exacerbate the brain drain.

A Deloitte report on FDI and Inclusive Growth outlined the case for a “positive and nuanced relationship between FDI and social progress” (Foreign Direct Investment and Inclusive Growth, The Impacts on Social Progress, 2014). Other studies on the determinants of successful cases of FDI agree on one key component in attracting and ultimately fostering inclusive growth: infrastructure (Craigwell, 2006; Kang & Martinez-Vazquez, 2022). This includes transportation facilities such as roads, bridges and (air)ports, as well as telecommunication networks and energy and information availability (Craigwell, 2006). Aside from infrastructure, however, researchers at the International Center for Public policy have found that the size of the manufacturing sector plays a key role in transforming FDI into growth that is inclusive (Kang and Martinez-Vazquez, 2021). Kang and Martinez-Vasquez (2021) also pointed to the technological and knowledge gap between the host country and foreign firms. Studies are in agreement that spillovers and linkages (employment created f.e.) are maximized when there is a less prominent gap, reflecting the “absorptive capacity” of a host country (De Mello Jr., 1997; Rodriguez-Clare, 1996). This also highlights the ways in which a higher proportion of the population with tertiary degrees and investment in digital skills can lead Aruba toward inclusive growth. Table 8 lists the delineated policy recommendations per sector and current issue.

Sector	Challenge	Policy Recommendation	Sustainable Development Goal
Education	Brain drain	1. Incentivize return to Aruba by creating jobs in fields for which future generations are studying (i.e., STEM, renewable energy)	SDG 7: Affordable and clean energy SDG 8: Decent work and economic growth
Education	Disconnect in investment and outcomes	1. Reduce significant investments in infrastructure by developing maintenance framework for buildings 2. Deviate toward greater investment in digital infrastructure 3. To increase outcomes, invest in continuous development of teachers and their resources 4. Provide tutoring services targeted toward children in disadvantaged communities ("leveling the playing field")	SDG 4: Quality Education SDG 10: Reduce Inequalities
Labor market	Mismatch in supply of jobs and demand of labor	1. Modernize the labor department (DPL specifically) to make way for active labor market policies, including bridging the gap in digital skills that will be more in demand in the future 2. Develop comprehensive (especially labor) immigration policies that concentrate on young highly-skilled and educated immigrants who can fill positions not currently being filled by locals , and contribute to the sustainability of SVB and AZV	SDG 8: Decent work and economic growth
Labor market	Rigidity in regulations and cost of doing business	1. Relax "job protection" regulations to create balance in job protection and labor market flexibility. Permit labor market to become more representative of diversity in society 2. Reduce "unnecessary red tape" by adapting the (1) establishment of business, and (2) permits and licensing ordinances to stimulate investment and job creation	SDG 8: Decent work and economic growth
Labor market	Significant share of service-based jobs and too few high-skilled jobs	1. Attract FDI in knowledge-based industries to reduce brain drain and encourage tertiary education (STEM and renewable energy technology)	SDG 4: Quality education SDG 8: Decent work and economic growth
Labor market/ economic resilience	Dependence on tourism sector	1. Diversify economy into a. Recruit knowledge based industries (STEM) to reduce brain drain and encourage pursuance of tertiary education b. Focus specifically on renewable energy technology and research that could provide Aruba with an opportunity to become a hub for LAC, NA markets due to strategic location	SDG 7: Affordable and clean energy SDG 8: Decent work and economic growth

Table 8. Policy recommendation by sector and challenge

7. Conclusion

The shift in measuring countries' development based solely on income to include social, political, and civil rights has fueled a body of research on the correlation between the human-centered approach and inclusive growth. The HDI, created by UNDP, includes health, education, and income dimensions.

In Aruba, the relationship between HD and EG does not inhibit an optimal, bidirectional relationship. While this study's findings point to a flow from HD to EG, other study findings highlight different directions for the relationship.

Reforms in Landspakket that will be implemented in Aruba in the coming years will influence HD in Aruba and the relationship between EG and HD. Whether the modifications in the educational system will cause an increase in HDI, or whether modernization of the tax system will make Aruba too expensive to live in, can only be determined in the future.

This study's results, such as the unidirectional flow from HD to EG, indicate the importance of emphasizing aspects of HD. This is especially vital in light of the poor performance in educational outcomes. Addressing this and related issues will be necessary to bring sustained and inclusive growth to Aruba in the future.

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3.

The Future of Work

Stephanie Werleman

Abstract

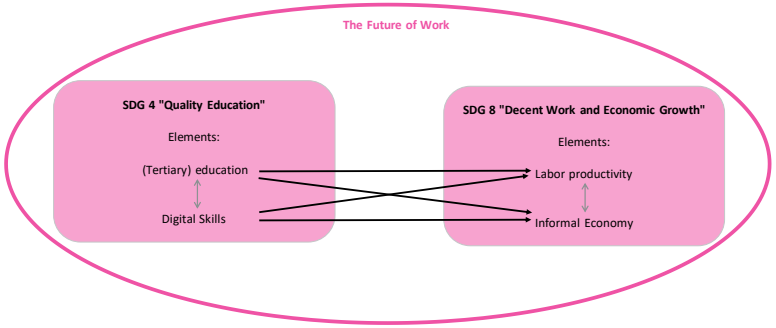
The Future of Work is here and we need to take action. This chapter aims to provide the Government of Aruba (GoA) with guidance in securing the Future of Work for Aruba. Our framework assumes that education and digital skills promote labor productivity and tackle the informal economy. We find evidence of a sluggish participation rate for tertiary education and difficulties in fostering digital skills in Aruba. It is recommended that the GoA – together with relevant partners – identify the structural factors that are lowering the tertiary education enrollment rate and take steps to implement a bridging program, encourage flexible and affordable tertiary education, and educate young people about the importance of tertiary education. Moreover, the GoA is advised to promote private investments in tertiary education. The GoA and the private sector have several tools that may be deployed to strengthen digital skills in Aruba. For the GoA these include but are not limited to, "lead by example" and implementing the Digital Education Plan. Recommendations to the private sector include, e.g., providing frequent training on 21st-century and digital skills. Importantly, employers also are encouraged to educate themselves on 21st-century skills for 2020 and 2025, particularly the importance of the four C's (communication, collaboration, critical thinking, and creativity).

3.1 Introduction

The Future of Work is here and the Government of Aruba (GoA) – together with the private sector – should act on it.

United Nations' Sustainable Development Goal (SDG) 8, "decent work and economic growth" is associated with the Future of Work. Following recommendations by the International Labour Organization (n.d.), employees and businesses in the informal economy should be incorporated into the formal economy to ensure decent work. Although multiple demand (e.g., discrimination) and supply (e.g., low education levels) factors and conditions affect the Aruban informal economy, to promote economic growth, higher levels of official labor are quintessential (De Social Economische Raad, 2021). Moreover, improved labor productivity has been proven to stimulate economic growth (Mahmud & Rashid, 2006). In relating this to our study, we acknowledge the existence of the Aruban informal economy paired with stagnant labor productivity. At the same time, SDG 8 has been proven to be causally related to SDG 4[1], "quality education" (Vladimirova & Le Blanc, 2015). For the specific case of Aruba, we find evidence of sluggish participation in education – particularly tertiary education – and difficulties in fostering digital skills. Therefore, the critical elements (i.e., education and digital skills) needed to promote SDG 8 are missing. In other words, to secure the Future of Work for Aruba, education and digital skills should be encouraged[2].

Against this background, this chapter aims to assist the GoA in adopting and implementing policies that secure the Future of Work for Aruba. Our framework assumes that promoting (tertiary) education and digital skills tackles the issue of low labor productivity and the informal economy (Figure 3.1).



Source. Author's design based on UNSDGs.

Figure 3.1 A framework for the Future of Work

[1] SDG 4 consists of several targets. For the purpose of this chapter, we focus on the participation in education – with a focus on tertiary education - and the development of digital skills.

[2] This chapter does not intent to be exhaustive with respect to all measures needed to secure the Future of Work on Aruba. In this chapter we only focus on (tertiary) education and digital skills.

The following research questions are explored in this chapter:

i. *What is the interrelationship among (tertiary) education, digital skills, labor productivity, and the informal economy? How are they interrelated?*
ii. *How do we promote equitable and inclusive tertiary education for all in Aruba?*
iii. *What is the current state of digital workforce skills? What measures should be taken to foster digital skills among the Aruban labor force and general community?*

The remainder of this chapter is structured as follows. First, section 3.2 reviews existing studies and discusses best practices in promoting tertiary education and digital skills. Next, section 3.3 discusses the specific case of Aruba. Then, section 3.4 provides policy recommendations. Conclusions are offered in section 3.5.

3.2. Evidence and best practices

In this section, we briefly review the main relationships illustrated in Figure 3.1. In addition, we discuss promising practices in advancing tertiary education and digital skills.

3.2.1 Education and labor productivity

Several studies have examined the relationship between education and labor productivity.

Using data from 30 countries, Chansarn (2010) found that education (measured in mean years of schooling) is a significant determinant of labor productivity. Similarly, Susansto and Purwiyanta (2014) identified a positive and statistically significant relationship between education (measured as school participation rate) and labor productivity in Indonesia. Likewise, Tabari and Reza (2012) showed that education (i.e., school participation rate) positively affects labor productivity in the agricultural sector in Iran. Moreover, Berger and Fisher (2013) noted that in the United States, labor productivity has grown more in states with broader expansions in educational attainment (i.e., the share of adults with at least a college degree).

Following the existing literature, education increases labor productivity through several channels. For example, an individual with a higher degree of education is more likely to be more efficient than someone with a lower education level as the former can complete more work in the same amount of time (Tabari & Reza, 2012). In addition, employees with a higher education level are better equipped to work longer hours and are healthier compared to their counterparts with a lower level of education (French & Fisher, 2009). Moreover, higher educated employees adapt quickly to changes and can communicate better with their coworkers (Decker et al., 1997).

3.2.2 Digital skills and labor productivity

Another branch of studies sheds light on the relationship between digital skills and labor productivity.

In analyzing the impacts of COVID-19 on labor productivity in Indonesia, Saputra et al. (2021) found that digital skills (consisting of the subcomponents of digital technical skills, digital communication, digital analytics, and digital mindset) positively affected labor productivity during the work-from-home period. Similarly, Markhaichuk and Panshin (2022) investigated the relationship between digital literacy and labor

productivity in Russian regions. The authors found that using Information and Communication Technology (ICT) has a positive and statistically significant effect on labor productivity with a lag of 1, 2, and 3 years. This finding indicates that advancements in digital skills have a prolonged impact on labor productivity. A recent paper by Borrowiecki et al. (2021) also confirmed that digital skills have a positive and statistically significant result on firm-level productivity growth in the Netherlands.

Related to digital skills, Bertani et al. (2020) provided evidence of a significant correlation between investments in ICT (e.g., software and databases) and labor productivity (and total factor productivity). This finding illustrates the importance of digital skills and investments in technological advancements for driving labor productivity.

3.2.3 Education and the informal economy

The existing literature provides evidence of the relationship between education and the informal economy.

Gërxhani and Werfhorst (2013) analyzed participation in the informal economy in Albania, finding a strong negative relationship between education and informal sector participation. In a similar vein, Jiménez et al. (2015) found that education (in terms of tertiary education) leads to growth in formal entrepreneurship. At the same time, they found that tertiary education has a negative effect on informal entrepreneurship. The authors also identified a positive relationship between secondary education and formal entrepreneurship. Similarly, Setyanti (2020) showed that higher educated workers are less likely to work in the Indonesian informal sector. Moreover, Setyanti (2020) revealed that people who have completed only primary to secondary education or do not hold training certificates have a greater probability of ending up in the informal economy. Using data from Nepal, Bolli et al. (2019) also proved that people who completed tertiary education are more likely to be employed in the formal economy than individuals with no education, secondary education only, or primary education only.

3.2.4 Digital skills and informal economy

The digital skills – informal economy nexus is less researched in the existing literature. However, we argue that digital skills can affect the size of the informal economy through labor productivity acting as a mediator variable. Section 3.2.2 previously provided evidence that digital skills have a positive and statistically significant effect on labor productivity. Based on this evidence, we argue that employees with fewer digital skills are more likely to participate in the informal economy as they are less able to participate productively in the formal economy.

3.2.5 Promising practices in promoting tertiary education

There are several pathways to promoting tertiary education enrollment, retention, and completion rates.

Several countries have implemented "bridging" programs for the transition into tertiary education (Salmi & Basset, 2012). For example, the World Bank and the Government of Romania established the Romania Secondary Education Project (ROSE). This program addresses the factors that prevent Romanian students from successfully transitioning from secondary to tertiary education and thereby promotes the retention rate for tertiary education (World Bank, 2015).

According to the World Bank, the program provides remedial activities, tutoring, counseling, extracurricular activities, internships, summer bridge programs, and learning centers. Participants include students and staff in low-performing secondary schools and first-year students at colleges and universities (World Bank, 2015).

Following Murthi et al. (2021), governments should promote the completion of tertiary education and focus on making participation equitable and inclusive. Equitable and inclusive tertiary education means that students from all socioeconomic statuses, including underrepresented groups, may participate in education (Murthi et al., 2021). By that means, governments should create policies that provide disadvantaged groups with access to tertiary education. In addition, governments should encourage the creation of blended and flexible tertiary education opportunities (Murthi et al., 2021). The latter accommodates the diverse needs of different groups.

UNESCO (2017) described several ways to promote (equitable and inclusive) tertiary education:

I. Governments are encouraged to establish "specialized" universities targeting minority groups. According to the UNESCO report, such practices are already visible in India, Pakistan, Mexico, New Zealand, and Colombia, among others. UNESCO also argues for implementing "affirmative action policies" to support disadvantaged groups. These policies could include numerical quotas for members of disadvantaged groups or other preferential treatments.
II. Governments should pass equal opportunities policies, equity, and affordability in tertiary education into the law. According to UNESCO, governments could establish national agencies that follow up on these policies. The national agency can keep track of equity policies through monitoring tools such as household surveys.
III. Participation in tertiary education should be made affordable. UNESCO recommends governments establish an agency responsible for means-tested grants and loans (i.e., the assistance provided is based on the student's or household's income). Moreover, they suggest that the maximum student repayment should be capped at 15 percent of monthly income.

Other similar paths to promote enrollment in tertiary education include no tuition or low fees for disadvantaged groups, grants, and student loans (Salmi & Basset, 2017). In addition, according to Salmi and Basset, universities could reform their selection procedures and/or create adapted admission programs for disadvantaged groups. This suggestion is similar to the recommendation made by UNESCO (2017). The authors also argued that students should be reached out to at a very young age to plant the seed of attending university at an early stage.

Lastly, Murthi et al. (2021) encouraged governments to strengthen their tertiary education programs with public resources. Benefits include but are not limited to higher employment and wages, improved productivity, advances in innovation, enhanced quality of health, increased social stability, and more effective public administration (World Bank, 2021).

3.2.6 Promising practices in promoting digital skills

This section elaborates on promising international practices in fostering digital skills. Here, we not only focus on developing

digital skills within the labor force but also on digital skills for the general community, and particularly by young people. Our choice is motivated by the fact that young people will be better prepared for the workforce if they become superior "digital natives[3]" (ITU, 2022).

The European way of promoting digital skills

A significant number of Europeans suffer from a digital skills gap (European Commission, n.d. -b). Furthermore, the European Commission (n.d.-c) predicts that the need for digital skills at work will only increase as the application of digital tools spreads across all economic sectors. Therefore, if unchanged, this lack of digital skills will become detrimental to the labor market and the future of businesses (European Commission, n.d. -b).

Driven by this risk, the European Commission developed various policies geared toward digital skills development. These include the European Skills Agenda, the Digital Education Action plan, and the Digital Skills and Jobs Coalition. We provide a brief summary of each program below.

The European Skills Agenda is a five-year plan targeted toward individuals and businesses; its aim is to broaden and deepen workforce skills (European Commission, n.d. -d). The agenda includes twelve actions and is organized into four building blocks. The European Skills Agenda calls for collective action, defines a clear strategy that ensures that skills lead to jobs, promotes a lifelong learning environment, identifies financial means to invest in (digital) skills, and sets objectives for upskilling and reskilling (Government of Ireland, n.d.).

The Digital Education Plan is a policy initiative that aims to foster digital skills through inclusive and accessible digital education in Europe and by supporting the adaptation of education and training systems of Member States (European Commission, n.d. -a). This policy initiative has been implemented for six years. It is based on two main priority areas/ stages: i) the development of a digital education ecosystem, and ii) the enhancement of digital skills and competencies for digital transformation (European Commission, n.d.).

The Digital Skills and Jobs Coalition is a collaborative effort among the government, companies, and organizations (European Commission, 2022). To join the coalition, companies (and organizations) pledge to take actions that boost digital skills (European Commission, 2022). These actions include but are not limited to training unemployed persons, offering coding classes for children, and providing online courses for teachers. According to the European Commission, the Digital Skills and Jobs Coalition targets four broad groups: all citizens, the labor force, ICT professionals, and educators.

Finally, the European Commission tracks digital skills progress by calculating and reviewing the Digital Economy and Society Index (DESI)[4].

[3] According to the Cambridge dictionary, "digital native" is someone who is familiar with digital technology (e.g., computers) because they have grown up with it (see: https://dictionary.cambridge.org/dictionary/english/digital-native). Therefore, "beyond digital natives" entails more than only being familiar with digital technology. This includes, but is not limited to, the acquisition of digital workplace skills and the safe usage of digital technologies (ECDL Foundation, 2014).

Other promising pathways in developing digital skills

Apart from the initiatives of the European Commission, there are several other promising pathways in developing digital skills. For example, the World Bank (2020) advocates for the inclusion of digital skills in the education curriculum - basic digital skills can be offered as a subject in primary and secondary education and in higher levels of education for students who did not have access to digital skills training in primary/secondary education. At the same time, they argue that intermediate digital skills training should be included as part of other courses for upper secondary and tertiary students. This inclusion could be achieved by integrating the usage of digital technologies across several subjects (World Bank, 2020).

Digital skills could also be promoted outside the formal education system. For example, the International Computer Driver's License (ICDL) is a computer literacy certification program that offers courses to beginners (without prior experience with computers or the internet) and professionals (ICDL, n.d.). The ICDL aims to increase digital competence standards in the workforce, education, and society. The ICDL is available in over 100 countries and has issued over 70 million certification tests.

Another example of teaching digital skills outside the classroom is the PraDigi program in India (World Bank, 2020). The PraDigi is offered by a non-profit institution (Pratham) that distributes 10,000 tablets to 50,000 children in the region. According to the source, the tablets are programmed with numeracy and literacy e-content content, thereby providing digital skills training on a self-paced and personalized basis. The contents are designed for children aged 3-14 years old. Progress is measured through PraDigi staff visits every week.

3.3. Aruba in context

In this section, we focus on the specific case of Aruba. We first present data on the Aruban informal economy and the dampened productivity. Then, we discuss the state of (tertiary) education and digital (workforce) skills.

3.3.1 The Aruban informal employment and informal economy

Our calculations on the informal sector show that, on average[5], Aruban informal employment is 25.0 percent of total employment, while the average informal economy stands at 9.1 percent of total (nominal) GDP. Our measurements align with estimated informal employment (i.e., 24.0 percent of total employment) and the informal sector (i.e., 11.0 percent of nominal GDP) of the former Netherlands Antilles[6]. Figure 3.2 shows Aruba's development in informal employment and informal economy over the past ten years.

[4] This index is composed of the following key areas: human capital, connectivity, integration of digital technology, digital public services, and Research & Development in Information and Communication Technology. Detailed methodological information can be found on the European Commission website at: https://digital-strategy.ec.europa.eu/en/policies/desi

[5] For the period of 2010-2021.

[6] See Carolina and Pau (2007).

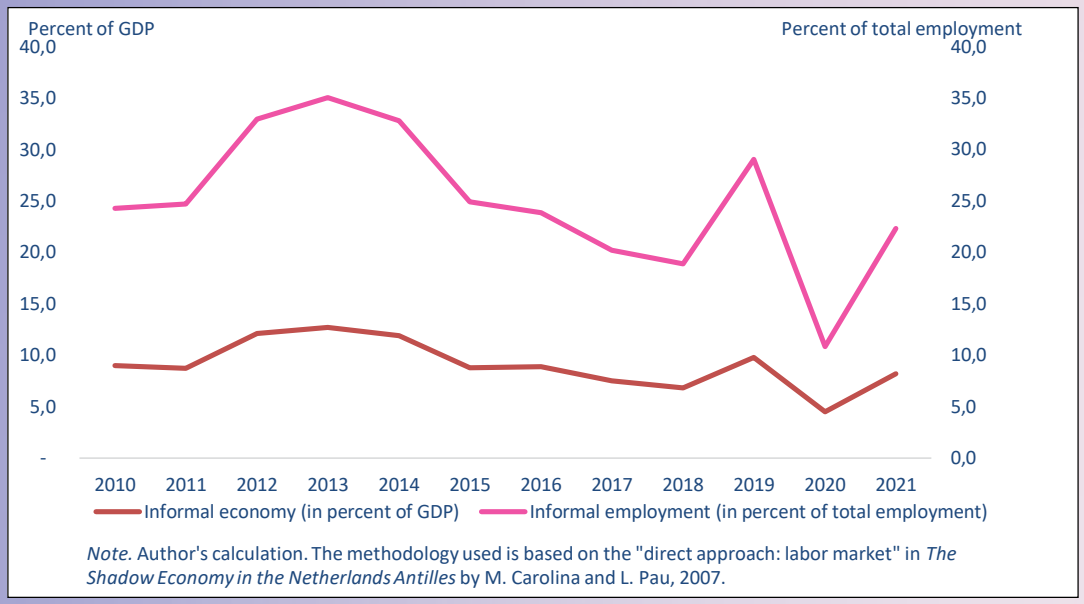


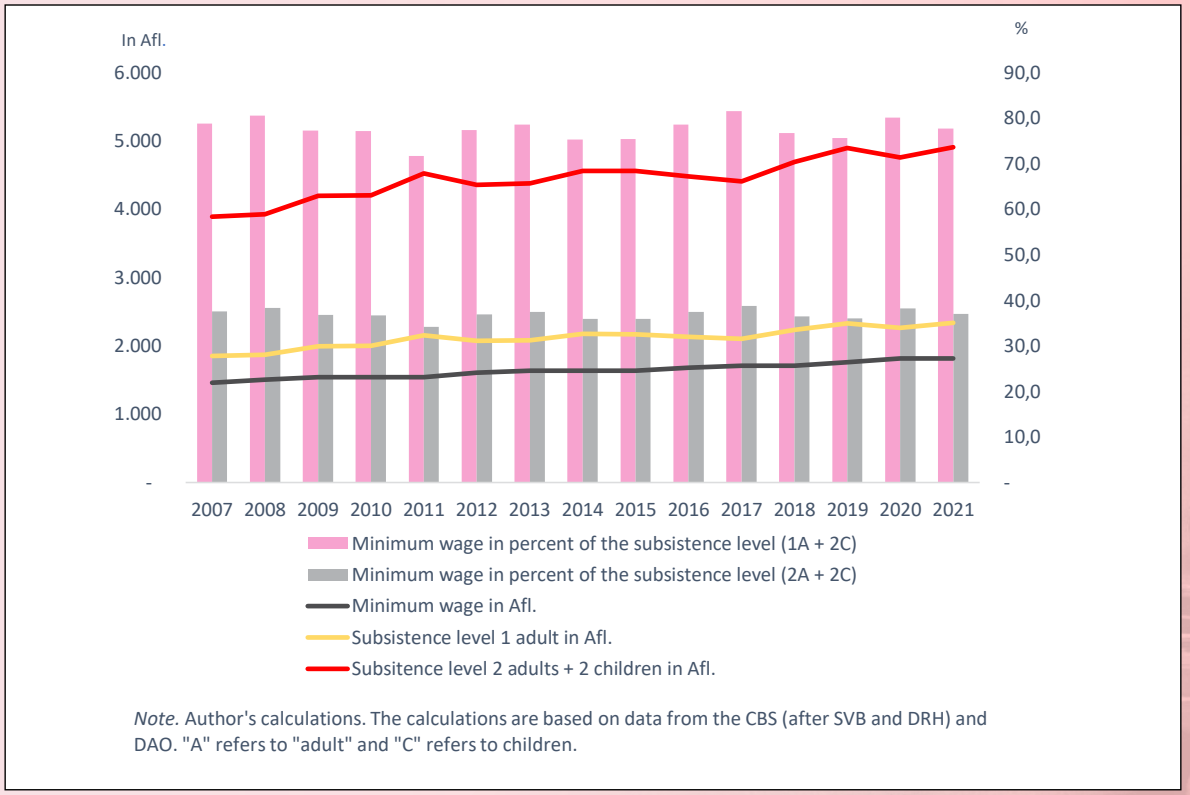
Figure 3.2 Informal employment (in percent of total employment) and informal economy (in percent of GDP) in Aruba

Data obtained from the Social Insurance Bank (SVB) show that the number of registered work relationships declined in 2019 compared to 2018, while data from the Labour Force Survey (LFS) indicate that the number of employed persons (both formal and informal workers) increased in 2019. The upward movement in the number of employed persons in 2019 was caused by the informal sector, resulting in a peak in the share of informal employment in 2019. The sharp decline in the percentage of informal work in 2020 is the direct effect of the COVID-19 pandemic. According to International Labour Organization (2020), informal workers were among the most affected during the lockdown and shelter-in-place measures, as working from home was generally not an option for them. Therefore, staying at home equaled losing jobs in most cases.

For the specific case of Aruba, informal employment as a percentage of total employment in 2020 was likely downward-exacerbated as formal workers were less impacted during the COVID-19 pandemic due to the financial assistance provided by the GoA. The reversal in 2021 resulted from the lifting of lockdown and shelter-in-place measures.

The Aruban informal economy follows a similar trajectory to that for informal employment. Therefore, the same explanations hold for the developments in the informal economy. In other words, the informal economy shrunk in 2020 due to lockdown and shelter-in-place measures imposed by the GoA to contain virus transmission. However, in 2021, the informal economy began to gain momentum as these measures were relaxed and no longer impacted production.

The consequences stemming from the Aruban informal economy for economic development warrant attention. According to the DEACI (2021), the effects of the informal economy include but are not limited to: an increase in the tax burden, money laundering, unfair competition with the formal sector, as well as downward pressures on (formal) employment and labor protection. Nevertheless, we cannot disregard the existence of "positive consequences," especially for (lower-skilled) workers. To be precise, workers who do not possess the education and skills to hold a job in the formal economy are more likely to end up in the informal economy. In addition, the informal economy provides the opportunity to narrow the gap between formal wages and the Aruban subsistence level (Figure 3.3). Specifically, workers can obtain a second job in the informal sector while having a primary job in the formal economy.



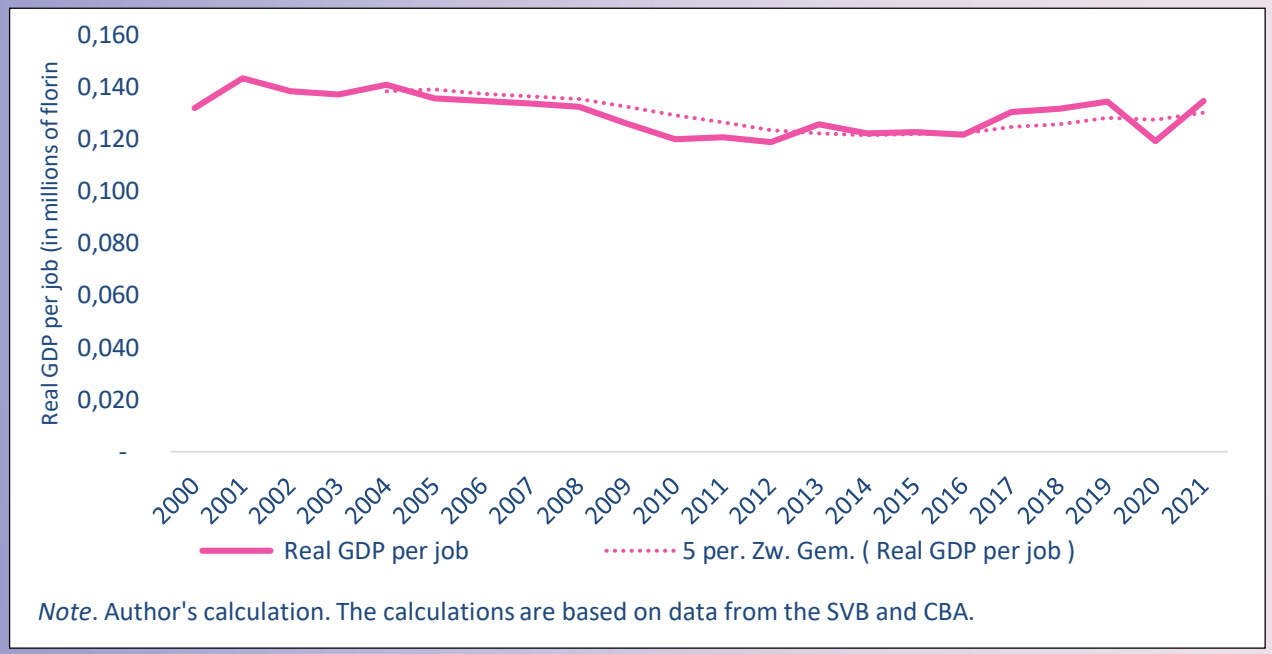
Note. Author's calculations. The calculations are based on data from the CBS (after SVB and DRH) and DAO. "A" refers to "adult" and "C" refers to children.

Figure 3.3 Minimum wage in percent of the subsistence level

Since the minimum wage in Aruba does not equal 100 percent of the subsistence level and about 20 percent of all employees earn equal to or less than the minimum wage[7], we argue that this gap also drives the Aruban informal economy.

3.3.2 Dampened labor productivity

We estimate labor productivity in Aruba using real GDP data and the number of registered jobs. We deviate from the standard measurement for labor productivity – output divided by the number of hours worked – due to the absence of data. Moreover, we do not use total employment figures due to data limitations. Figure 3.4 illustrates a lack of improvement in labor productivity during the period under review.



Note. Author's calculation. The calculations are based on data from the SVB and CBA.

Figure 3.4 Labor productivity (real GDP per job, in millions of florins)

[7] Based on data presented in CBS (2019).

A mostly downward trend could be observed when analyzing a 5-period moving average for this indicator. Our results are similar to the International Monetary Fund (2021). According to the International Monetary Fund, Aruba's labor productivity and total factor productivity (TFP) have been declining since 2000. They argue that (secondary) education enrollment should be increased and investments in digital technologies should be made to reverse this trend.

Moreover, the declining Aruban labor productivity is in line with the productivity slow-down in the Emerging Market and Developing Economies (EMDEs). According to Dieppe (2021), global productivity suffered following the 2007-2009 Global Financial Crisis (GFC) as a result of, e.g., deteriorated confidence, increased uncertainty, and lower earnings. In addition, they warn that labor productivity could further be pushed down following the COVID-19 crisis. In the specific case of Aruba, labor productivity declined significantly during the COVID-19 pandemic. This contraction is likely the effect of the COVID-19 wage subsidy provided by the GoA to Aruban businesses that led to a smaller decrease in the number of jobs compared to the downturn in real GDP in 2020. The sluggish development in labor productivity raises concern for the inclusive development of the Aruban economy. According to Dieppe (2021), labor productivity is the primary source of per-capita income growth, which is the key driver of poverty reduction. In line with the International Monetary Fund (2021) recommendations for Aruba, Dieppe also argued for accelerating education and digital technologies to boost productivity in the long term.

3.3.3 Low participation in tertiary education in Aruba

Before proceeding to discuss the participation rate in tertiary education in Aruba[8], we note that the enrollment data do not include Aruban students studying abroad. Therefore, we only consider students enrolled at institutions located in Aruba. However, we cannot disregard the fact that the tertiary education enrollment rate could have been significantly higher if Aruban students studying outside Aruba could have been included. Nevertheless, there is no guarantee that Aruban students in foreign countries will return and contribute with the positive effects of tertiary education. To extend our analysis, we use an alternative indicator - percentage of the population with a tertiary education degree - to account for the tertiary education graduates available to the labor market in Aruba.

Moreover, we compare the participation in tertiary education in Aruba to that in countries in the region. This comparison might be biased since the comparable countries might have more tertiary education institutions available. Therefore, they might not have the same number of students studying abroad. Moreover, countries in the region might not have the same study facilities (i.e., "Aruba lening") or possibilities to study abroad as those in Aruba.

Available education data for Aruba reveal that secondary and tertiary education participation rates are below those for comparable countries (Figure 3.5).

[7] Data on the completion (rate) of tertiary education were requested from the Department of Education Aruba (DEA). However, this yielded no response.

Note. Author's calculation. The tertiary education enrollment rate for Aruba was calculated by the author based on data received from the CBS, DEA, and CBA. The source for the enrollment rates for Latin America and the Caribbean is the World Bank. The enrollment rates of the Latin America and the Caribbean are calculated as total enrollment divided by the amount of persons of the official age for that level of education. Refer to https://uis.unesco.org/en/glossary-term/gross-enrolment-ratio-tertiary-education-sex

Figure 3.5 Secondary and tertiary education enrollment (in percent) for Aruba

Figure 3.5 reveals that in 2016, only 52.4 percent of all persons between the ages of 10 and 19 were enrolled in secondary education in Aruba. Meanwhile, 41.1 percent of all persons between 20 and 24 were registered in tertiary education. The enrollment rates for secondary and tertiary education remained below those for Latin America and the Caribbean in recent years. To account for Aruban students enrolled in tertiary education abroad, we analyze the portion of the total population with a tertiary education degree. Data obtained from the World Bank[9] show that only 12.5 percent of the total population has a tertiary education degree. This rate is below that of Latin America and the Caribbean (i.e., an average of 18.6 percent according to the World Bank). Following the SDG Aruba (2017), this rate is significantly below the benchmark of 30.0 percent required for a knowledge economy. This lack of development in tertiary education led to a limited number of local professionals (SDG Aruba, 2017).

The developments discussed above warrant attention. We observed that the participation in tertiary education in Aruba remained below that of Latin America and the Caribbean. We also acknowledged that this participation rate does not include Aruban students abroad pursuing a tertiary education degree. To account for Aruban students studying abroad and returning to work in Aruba, we included an alternative indicator into our analysis: the portion of the population with a tertiary education degree. This portion is also below that of Latin America and the Caribbean. Our analyses indicate that the GoA should aim to promote tertiary education either by stimulating enrollment at local educational institutions or creating policies that deter brain drain. According to Salmi (2020), tertiary education is of critical importance in achieving the SDGs proposed by the UN as it impacts economic and social development within a country. Specifically, developments within tertiary education can equip nations with knowledge and a qualified workforce to deter poverty and advance economic growth (Salmi 2020, after the World Bank 2000). Moreover, tertiary education supports primary and secondary education by stimulating the capacity building of teachers, school principals, and curriculum developers (Salmi, 2020). In addition , Salmi argued that tertiary education is directly related to the health SDG (i.e., SDG 3), as the pillars of a country's health system are trained and educated at universities and colleges (Salmi, 2020). Importantly, tertiary education graduates have the necessary skills to push the fourth industrial revolution (Murthi et al., 2021). The latter will change the nature of production and work and, therefore, labor productivity.

3.3.4 The state of digital skills in Aruba

Several studies suggest a lack of digital skills in Aruba. The latest measurement – estimated in 2019 – by the Aruba SDG-indicator Working Group (2021) showed that 50 percent of Aruba's youth and adult population had information and communications technology (ICT) skills[10]. At the same time, evidence provided by Black et al. (2019) pointed to difficulties in fostering digital skills: although Aruba has a high mobile penetration rate, many Arubans are not comfortable using computers and productivity software (e.g., Microsoft Office and

[9] https://genderdata.worldbank.org/indicators/se-ter-cmpl-zs/

[10] For the purpose of this chapter, we use "ICT skills" and "digital skills" interchangeably. Further information on the measurement of this indicator is available on: https://sdgaruba.com/pages/wp-content/uploads/2022/07/FINAL_SDG-IWG-INDICATORS-2021_REPORT.pdf

online banking). Furthermore, the Government of Aruba (2020) recognized “low digital literacy and digital capabilities” (p. 11) as one of the main challenges in moving towards a digitalized economy. The latter is of critical importance as this transition is believed to be among the catalyzing factors in economic recovery and resilience building during the post-pandemic period (Government of Aruba, 2020).

To further deepen our insights into the (future) state of digital skills in the Aruban workforce, we conducted a “Future of Work – Digital Skills Survey[11]” among Aruban employers. In addition to focusing on digital skills, we also gathered information on general 21st-century skills. The latter consist of critical skills (e.g., creativity) for fostering digital skills and securing a successful digital transformation in the workplace. Survey results are described in the following sub-sections.

Demographics

Figure 3.6 shows that most (i.e., 34.5 percent) of the respondents are from the “financial and insurance activities” industry. We split the sample for financial institutions (FI) and non-financial institutions (NFI) to identify any significant differences between FI and NFI[12].

[11] We initially calculated a sample size of 103 companies based on a confidence interval of 95 percent, margin of error of 5 percent, and a population of 141 companies. The latter is equal to the total of members of the ATIA. The survey was electronically distributed to AHATA (140 members) and ATIA (141 members), and the institutions under supervision of the Central Bank of Aruba. Given the diversity in the perception of employees, we requested two representatives to fill in the survey (for each company). Therefore, the aim was to obtain 206 responses. Nevertheless, only 86 completed surveys were returned. Given the low response rate, we must note that the results might not be representative of the average company.

[12] The data do not allow us to make a more in-depth analysis across the economic sectors.

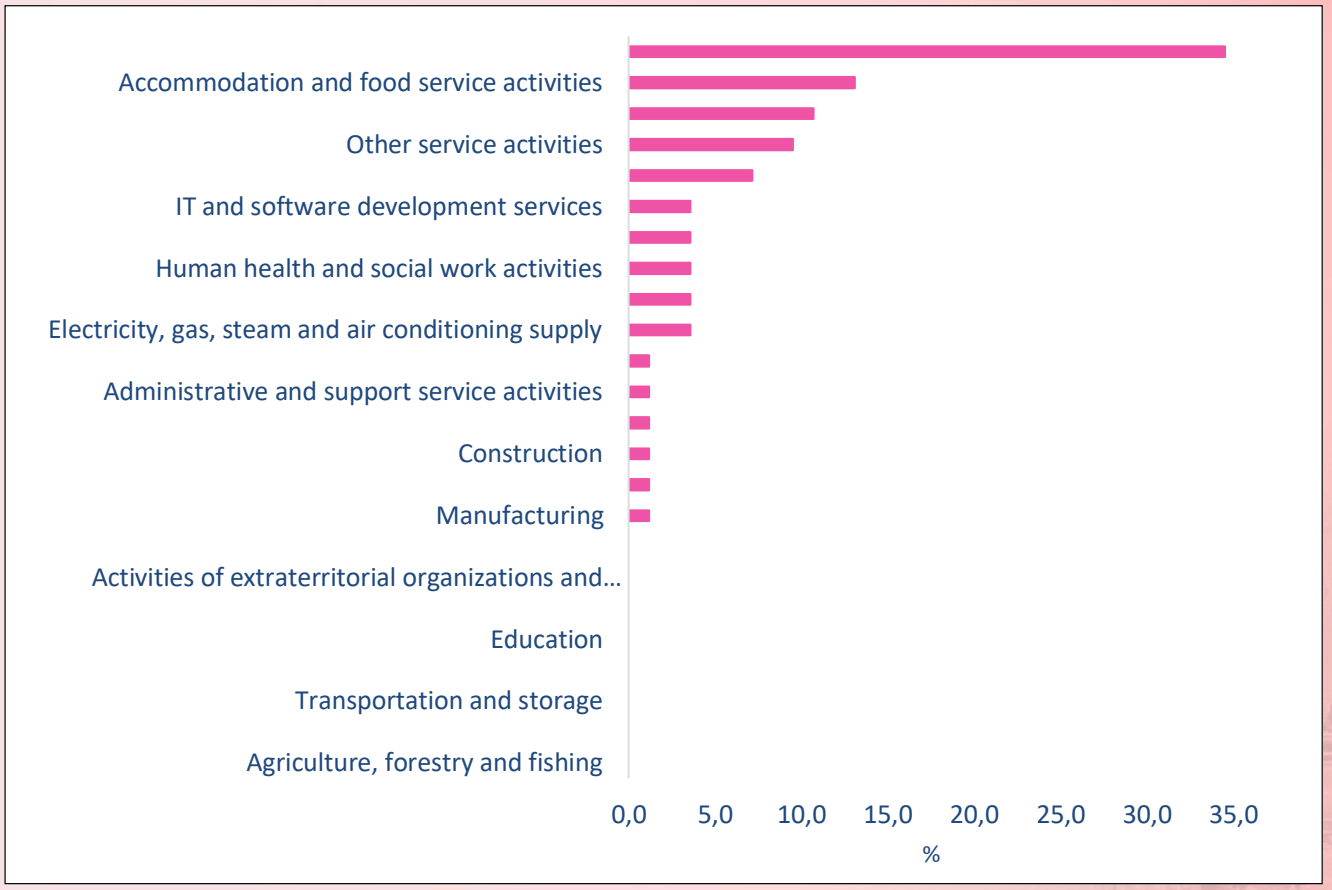
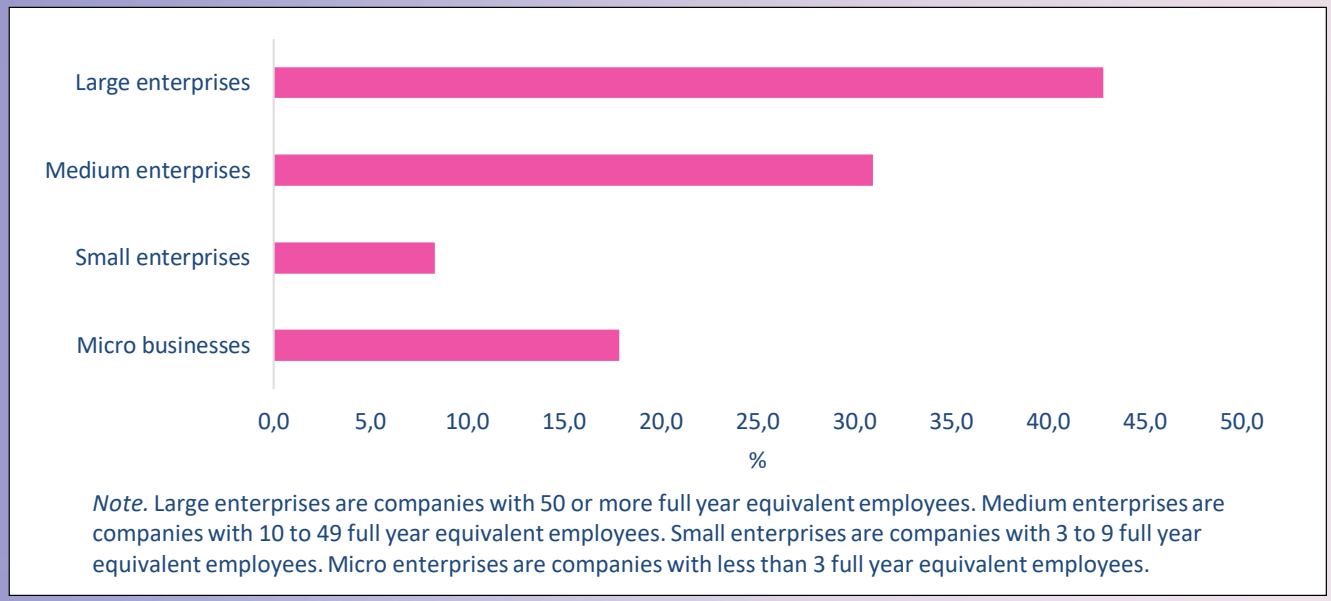


Figure 3.6 Main line of industry (percent of respondents)

Most participating companies (i.e., 42.9 percent) are considered 'large enterprises' (Figure 3.7). The latter are companies with 50 or more full-year employees (DEACI, 2019).

Given this variability, we also aim to determine if there are significant differences in the survey results based on company size.



Note. Large enterprises are companies with 50 or more full year equivalent employees. Medium enterprises are companies with 10 to 49 full year equivalent employees. Small enterprises are companies with 3 to 9 full year equivalent employees. Micro enterprises are companies with less than 3 full year equivalent employees.

Figure 3.7 Size of companies (percent of respondents)

Figure 3.8 shows that most respondents (i.e., 63.1 percent) were directors, CEOs, and board members. Managers participated to a lesser extent in the survey. We cannot disregard the possibility that the survey results would have differed if more managers had participated.

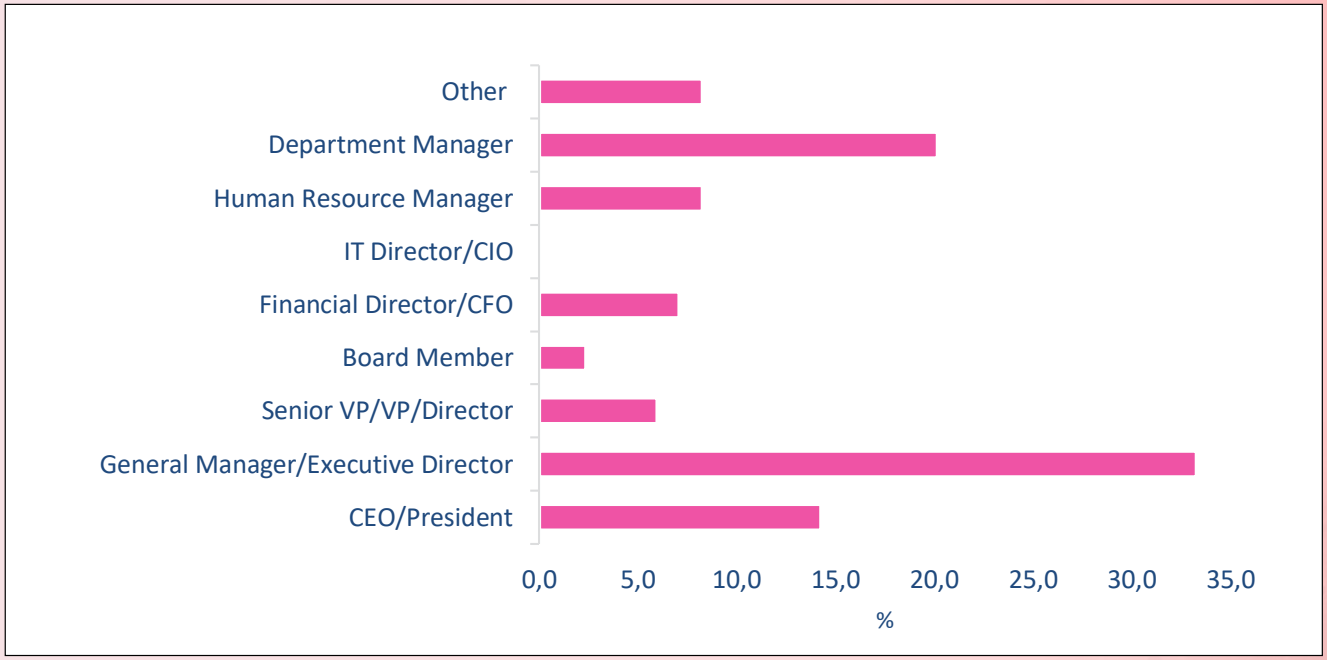


Figure 3.8 Role of respondent (percent of respondents)

Top 10 skills - Aruba	
2022	2017
1. Service orientation ↔	1. Service orientation
2. Quality control ↑	2. Critical thinking
3. Ethical behavior ↑	3. Communication ability
4. People management ↔	4. People management
5. Critical thinking ↓	5. Quality control
6. Complex problem solving ↑	6. Creativity
7. Technical/IT competence ↑	7. Ethical behavior
8. Communication ability ↓	8. Flexibility
9. Change orientation ↑	9. Complex problem solving
10. Emotional Intelligence	10. Technical/IT competence
Note. "Emotional intelligence" was not measured in 2017.	

Table 3.1 Top 10 skills 2020 vis-a-vis 2017

21st-century skills

We compare the top 10 skills measured in our survey to the Isla Innovativo Survey distributed in 2017 (Table 3.1).

The results show that the top ten skills in 2022 are slightly different compared to 2017. Moreover, the growing importance of digital skills is evident as "technical/IT competence" places seventh in 2022, compared to tenth in 2017. Nevertheless, the current skills profile of the Aruban labor force is not in line with the top ten skills identified by the World Economic Forum for 2020 or 2025 (see Appendix A). Instead, it seems the current profile lags as it has some characteristics of the top 10 skills of 2015 (see Appendix A).

The lack of an updated skills profile becomes more evident when benchmarked against the "four C's" (communication, collaboration, critical thinking, and creativity). The latter is considered crucial in succeeding in the 21st century and requires that labor participants are communicators, creators, critical thinkers, and collaborators (Chiruguru, 2020). Yet, in 2022, two out of the "four C's" (communication, collaboration, critical thinking, and creativity) are included in the bottom five skills for Aruba (Table 3.2). Meanwhile, "communication ability" places eighth in the current survey.

Bottom 5 skills - Aruba	
2022	2017
11. Task coordination	11. Negotiation ability
12. Flexibility	12. Task coordination
13. Negotiation ability	13. Change orientation
14. Curiosity	14. Curiosity
15. Creativity	-

Note. "Emotional intelligence" was not measured in 2017. As a result, we only rank the bottom four for 2017.

Table 3.2 Bottom five skills 2022 vis-à-vis 2017

A similar conclusion can be drawn when comparing the Aruban skills profile to other studies on skills for the 21st century. According to Hill et al. (2022), adaptability, creativity, curiosity, and comfort with ambiguity are the most critical skills for success in digital transformation. Similarly, Kane et al. (2016) found that a change-orientation mindset (e.g., the ability to embrace change, flexibility, adaptability, and curiosity) is the essential skill set for success in the digital workplace. For Aruba, these skills mainly appeared in the bottom five.

Therefore, our findings illustrate that Aruban executives have not yet realized the importance of 21st-century skills for digital transformation. Instead, they seem to only focus on the skills currently necessary for the Aruban labor market (e.g., service orientation). This finding is a cause for concern given the dramatic acceleration toward a digital business model as a

result of the COVID-19 pandemic (KPMG, 2021). Therefore, the current skills profile might work for now but is not guaranteed to perform in the future.

With regard to differences between NFI and FI, Chi-square tests showed that NFI tend to prioritize "quality control" (i.e., p = 0.074) and "flexibility" (i.e., p = 0.031), while FI tend to put the importance on "emotional intelligence" (i.e., p = 0.026) and "ethical behavior" (i.e., p = 0.081).

The current state of digital skills

Of all respondents, 46.9 percent indicated that their employees' digital skills are "good" or above (Figure 3.9). Meanwhile, 78.8 percent revealed that their employees' digital skills are equal to or above "fairly good."

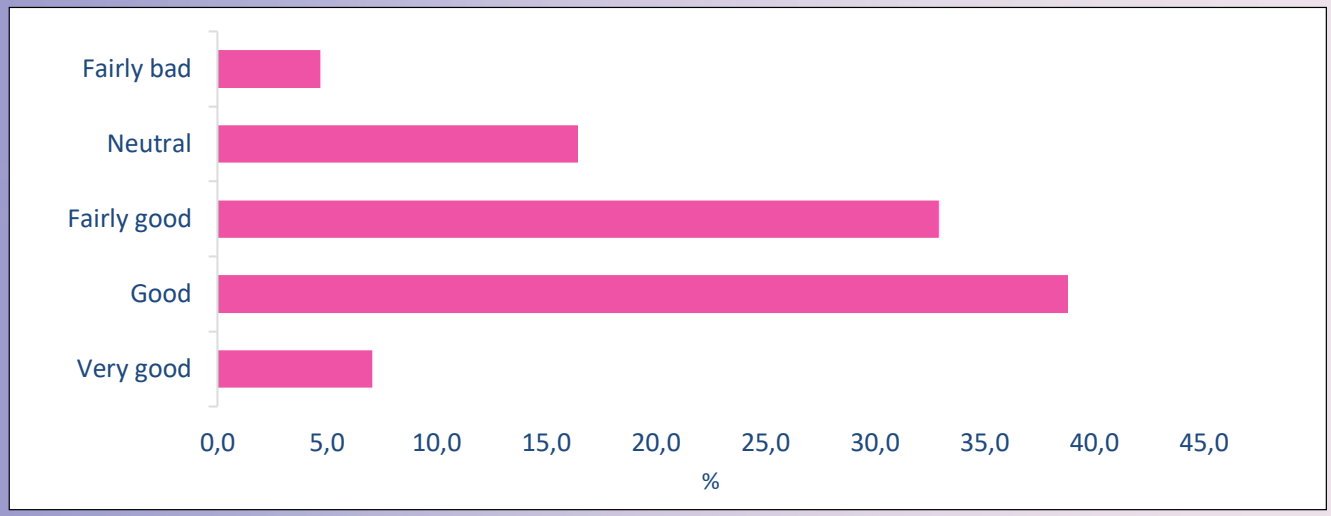


Figure 3.9 Current level of digital skills of employees (percent of respondents)

We also asked the respondents to rate their employees on specific components of digital skills (Table 3.3). They indicated that their employees ranked highest on the components of "communication and collaboration" and "information and data literacy." Meanwhile, they ranked lowest on the components of "digital content creation" and "problem-solving."

Competence	Mean	Std. dv.
Communication and collaboration *Examples: the ability to communicate with others through, e.g., a mobile phone, e-mail, or chat*	5.8	1.0
Information and data literacy *Examples: the ability to search for information online using a search engine, the ability to store files and retrieve them back once they are saved*	5.6	1.2
Cybersecurity *Examples: the employees are aware that their username and password can be stolen, that private information should not be shared online, and on the basic steps to protect their devices (e.g., setting up passwords)*	5.4	1.4
Problem-solving *Examples: the ability to use digital tools to solve problems, to find support and assistance when confronted with technical issues with digital devices, and awareness of basic solutions to routine problems (e.g., force close program, restart the computer, verify internet connection)*	5.1	1.4
Digital content creation *Examples: the ability to produce simple digital content (e.g., tables, images, audio files, social media content)*	4.9	1.3

Note. Measured on a Likert scale: 1 = "very bad", 2 = "bad", 3 = "fairly bad", 4 = "neutral", 5 = "fairly good", 6 = "good", 7 = "very good"

Table 3.3 Ranking of employees on digital skills

Results appear to show that employees' current level of digital skills is "good enough" for the current requirements of the Aruban labor market. However, since the current skills profile of the Aruban workforce appears to be "outdated" and "technical/IT competencies" placed seventh in the current survey, we argue that executives currently overrate their employees' level of digital skills. In this context, our results could be interpreted as: employees' level of digital skills is not at the level required for the digital transformation.

A Chi-square test showed that the ranking on the "digital content creation" component is associated with the main type of business. Specifically, employers in FI tended to rank their employees higher in this component compared to NFI (i.e., p = 0.091). This finding might be related to the social media presence of FI and their move toward digital products and services.

Digital skills – now to the future

We also compare the importance of digital skills now and in the future (i.e., 3–5 years). The results indicate that, to date, 52.4 percent of all respondents believe digital skills are "very important" in their workplace. This percentage climbs up to 75.0 percent when asked about the future importance of digital skills (Table 3.4)[13].

Degree of importance	Now	Future (i.e., next 3-5 years)
Very important	52.4	75.0
Somewhat important	39.3	22.6
Neutral	4.8	0.0
Somewhat unimportant	1.2	0.0
Totally unimportant	2.4	2.4

Table 3.4 Degree of importance of digital skills (percent of respondents)

[13] The difference in the importance of digital skills now vs. the future is significant (t(82) = -2.350, p = 0.021).

Figure 3.10 reveals that 71.4 percent of all respondents indicate that in the future, employees' level of digital skills should be equal to or above the intermediate level.

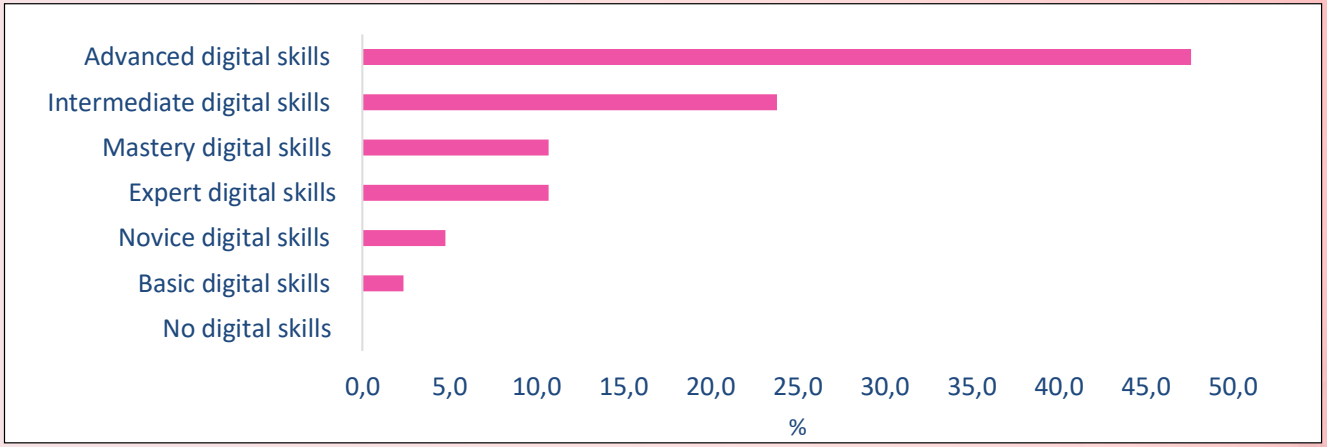


Figure 3.10 Desired level of digital skills in the medium term (percent of respondents)

Our results – based on Chi-square tests – suggest that the importance of digital skills differs for NFI and FI. Specifically, in the current state, digital skills are considered more important for FI ($p = 0.056$) compared to NFI. The same conclusion may be reached when analyzing data pertaining to the future importance of digital skills. Digital skills are considered more important for FI ($p = 0.002$) compared to NFI. This finding also might be related to the move toward digital products and services in FI in the aftermath of the COVID-19 period.

Barriers to adopting digital technologies

Respondents also were asked about the barriers to adopting digital technologies in Aruba (Figure 3.11).

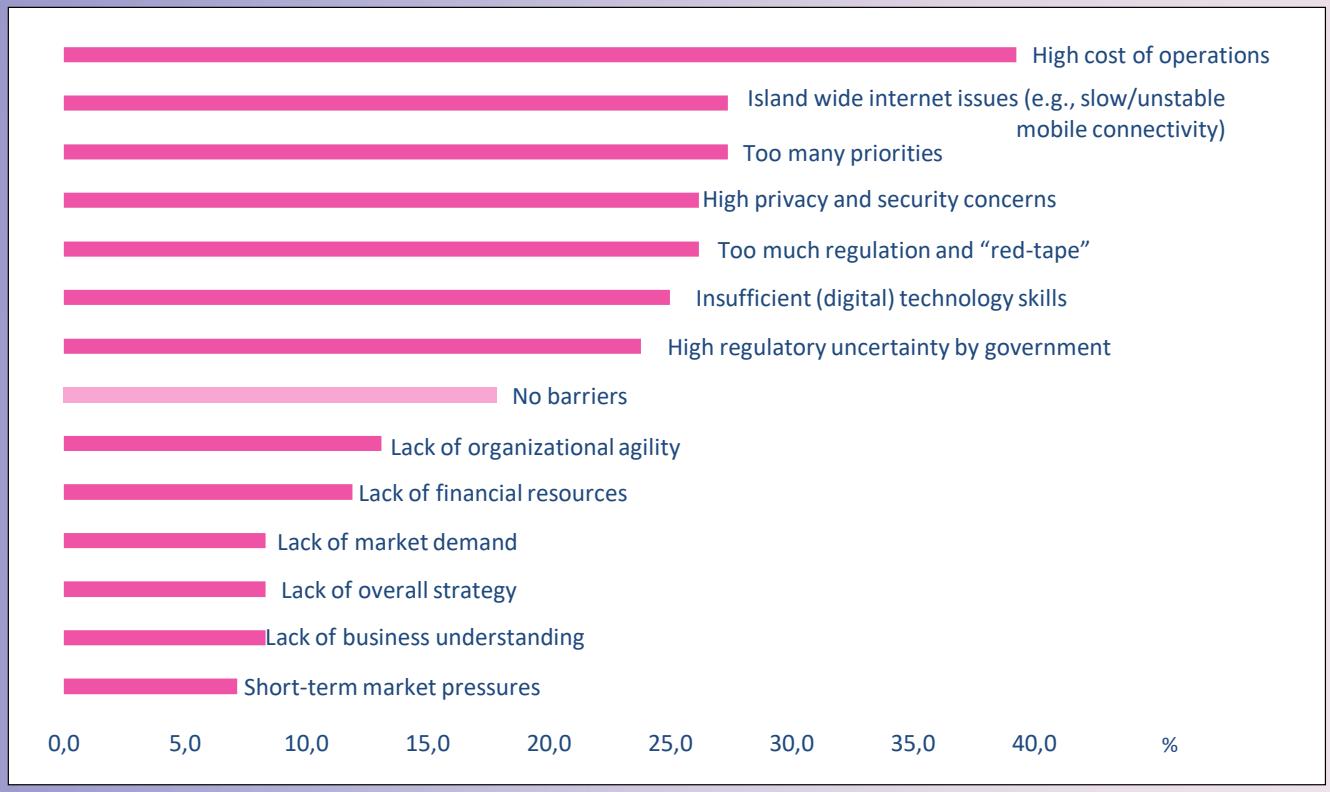


Figure 3.11 Biggest barriers to taking advantage of new digital technologies (percent of respondents)

The three most considerable barriers to adopting new digital technologies are the high cost of operations, island broad internet issues, and too many priorities. Nearly all barriers (in the top 10) are external factors related to the government. This finding might indicate a lack of willingness to act until the government improves the business environment. On the other hand, this might also point to a "self-serving bias" where businesses blame outside factors for lack of action.

Our analysis (i.e., Chi-square tests) indicates that NFI are more likely to identify "island wide internet issues" ($p = 0.043$) as an existing barrier compared to financial firms. At the same time, FI are more likely to cite "no barriers" in the adoption of new digital technologies ($p = 0.091$). This outcome might indicate that FI are more well-equipped for the digital transformation compared to NFI.

We also found that company size is related to barriers in adopting new digital technologies. Specifically, micro, medium, and small enterprises are more likely to identify the lack of financial resources as a barrier to adopting new digital technologies (based on a Chi-square test, p = 0.070).

The survey results also were presented to industry experts.

The industry experts do recognize that the skills profile of the Aruban labor market is not in line with the top 10 skills identified by the World Economic Forum for 2020 or 2025. However, this is not a cause for concern for them as the needs of the Aruban labor market might be different compared to international standards. They also foresee that "service-orientation" will remain the top 1 skill within the Aruban labor market, due to the nature of the service-oriented economy.

Along the same lines, the industry experts agree that employees' levels of digital skills are "good enough" for the current needs of their industries. However, they do recognize the need to further advance digital skills in the future. Nevertheless, this does not automatically translate in an update of the current skills profile of the Aruban labor market or more frequent digital skills training.

Box 3.1 Conversations with industry experts

3.3.5 Interrelationship across the elements

We attempted to analyze the relationship across the elements presented in Figure 3.1. Due to a lack of data, we omit the aspect of "digital skills." We utilize the correlation analysis method.

The informal economy is quantified according to percent of GDP. Informal employment is measured in percent of total employment; labor productivity is calculated as real GDP per registered job in millions of florins; secondary education is measured as secondary education enrollment to the total population ages 10-19; and tertiary education is proxied by tertiary education enrollment to the total population ages 20-24. The results are shown in Table 3.5.

Correlations							
	Secondary education	*Tertiary education*	*Secondary education (t-1)*	*Tertiary education (t-1)*	*Labor productivity*	*Informal employment*	*Informal economy*
Secondary education	1.000						
Tertiary education	0.418	1.000					
Secondary education (t-1)	.581**	0.390	1.000				
Tertiary education (t-1)	0.203	.873**	0.418	1.000			
Labor productivity	.510*	(0.325)	0.327	-.525*	1.000		
Informal employment	(0.513)	0.186	-.889**	(0.266)	(0.067)	1.000	
Informal economy	(0.540)	0.093	-.861**	(0.231)	(0.129)	.993**	1.000

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Table 3.5 Results for the correlation analyses

Table 3.5 indicates that secondary education is significantly positively correlated with labor productivity. This finding points to the importance of secondary education in promoting higher levels of labor productivity in Aruba. This finding is also in line with the recommendations of International Monetary Fund (2021) to foster secondary education enrollment to increase productivity. Moreover, secondary education is significantly negatively correlated with informal employment and the informal economy. Therefore, secondary education might deter the informal economy. Our result is in line with other research such as Gërxhani and Werfhorst (2013) which proved that education decreases informal sector participation.

Contrary to our expectations, we find a significant negative correlation between tertiary education (with a lag of 1 year) and labor productivity. This result is similar to the results from Liu and Bi (2019). In their study, Liu and BI (2019) found that master and technical school graduates have a negative effect on TFP growth in China. They argue that this is related to the quality of these degrees. Applied to Aruba, this may indicate that the service-driven (tourism) economy and related labor productivity may not be readily and comprehensively affected by enrollment rates in tertiary education, in contrast to enrollments in secondary education. On the other hand, tertiary education was proxied by tertiary education enrollment in the correlation

analysis and does not indicate how many students actually graduate from tertiary education in Aruba. Moreover, we were not able to obtain long-run historical data for the indicators analyzed in Table 3.4. Furthermore, the omission of data on student enrollment and graduation rates in international tertiary education is a significant weakness. Hence, the results of the correlation analyses should not be over-interpreted.

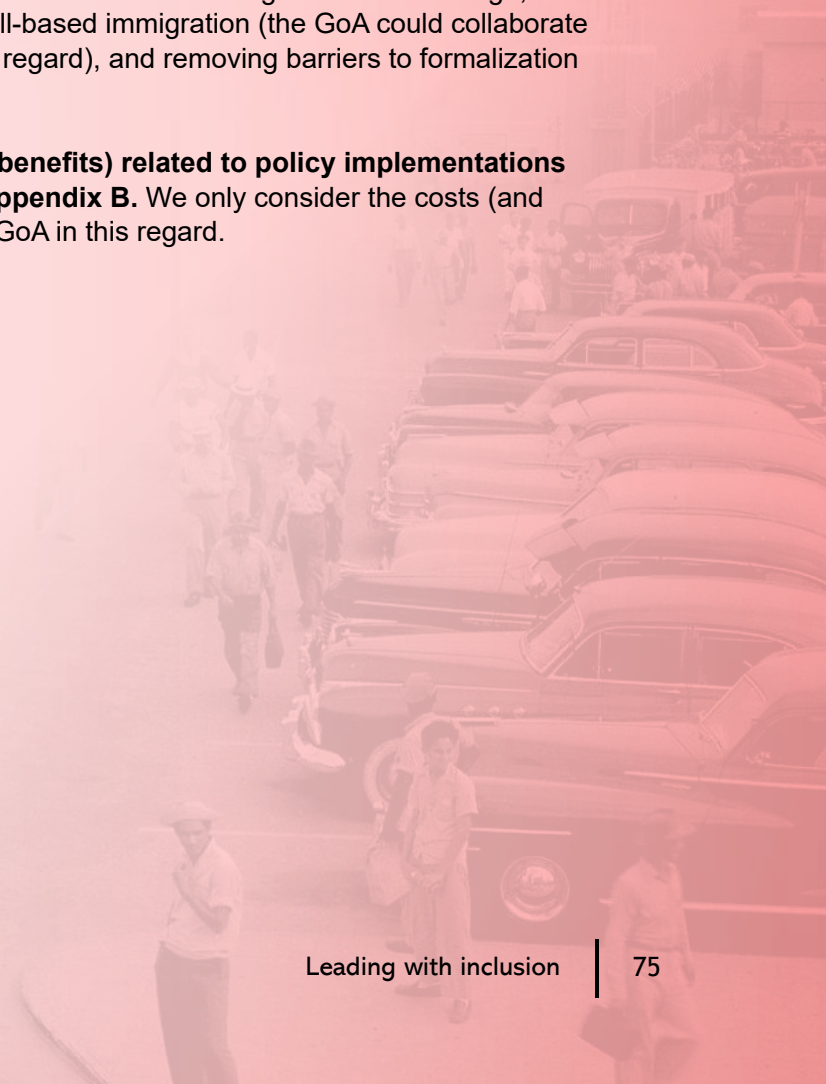
3.4. Policy recommendations

In section 3.3.3, it was shown that the participation rate for tertiary education in Aruba and the portion of the population with a tertiary education degree are below international benchmarks. Against this background, in this section, we provide policy recommendations for the promotion of tertiary education in Aruba (Table 3.6).

With regard to the level of digital skills, existing studies provided evidence of a lack of digital skills in the general community in Aruba. The survey conducted within the business sector showed that the level of digital skills and the 21st-century skills profile work for now. However, given that digital transformation is accelerating, Aruban executives must ask themselves several questions: how long can employees effectively perform under the current skills profile? How long is too long to wait before training employees for the digital transformation? How long before Aruba catches up with international trends in digital transformation? Therefore, in this section, we also provide policy recommendations on the fostering of digital skills (Table 3.7).

The recommendations presented in Tables 3.6 and 3.7 are not intended to be exhaustive with regard to all strategies for promoting labor productivity and mitigating informal employment. Following our framework, we mainly focus on the development of tertiary education and digital skills to improve labor productivity and reduce the informal economy. Other suggestions for improving labor productivity include accelerating digital financial inclusion and enabling more labor market flexibility (International Monetary Fund, 2021). Alternative pathways to be explored for mitigating informal employment include but are not limited to increasing the minimum wage, implementing skill-based immigration (the GoA could collaborate with HIAS in this regard), and removing barriers to formalization (e.g., red tape).

The costs (and benefits) related to policy implementations are offered in Appendix B. We only consider the costs (and benefits) for the GoA in this regard.



Dimension	Recommendations
Inclusive and equitable tertiary education	**Identify structural factors that lead to a low tertiary education enrollment rate in Aruba.** Conduct a study to identify the structural factors causing a low enrollment rate in tertiary education in Aruba. This study should also aim to identify the groups prone to not enroll in tertiary education after secondary education and/or drop out. **Implement a bridging program.** The GoA, together with partners (e.g., the university) providing tertiary education, may seek to establish – or fortify an existing - bridging program. The bridging program should target students enrolled in their last year(s) of secondary education and first-year students enrolled in tertiary education. Examples of bridging program activities could include counseling and tutoring. **Encourage flexible tertiary education**. Flexible tertiary education should include the option of e-learning (online programs). In addition, specialized university tracks (or adapted programs) should also be offered to disadvantaged groups. Flexible tertiary education should also include part-time programs. **Tertiary education should be affordable.** The GoA should ensure that existing student loan repayments do not exceed 15 percent of monthly income. Another pathway that the GoA could explore is the promotion of funding (e.g., scholarships) from the private sector to disadvantaged groups by providing tax incentives to businesses that offer scholarships to the community. The GoA could also increase its subsidies in tertiary education in Aruba. **Promote private investments in tertiary education.** It is recommended that the GoA promotes the investment of private (external) resources by eliminating the red rape in its public administrations. **Educate young people about the essence of tertiary education.** The GoA, together with relevant partners, should reach out to young students (primary and secondary education) to educate them about the essence and importance of tertiary education.

Table 3.6 Policy recommendations (tertiary education) – Future of Work

Dimension	Recommendations
Digital skills (GoA)	**Implement the Aruban Skills Agenda[a].** The Aruban Skills Agenda is based on the European Skills Agenda. The latter is a five-year plan aimed at individuals and businesses. The program is built on the same four principles as the original plan of the European Commission. Therefore, on a broad level, the Aruban Skills Agenda can look as follows: 1. *Call for a collaborative effort between GoA and the private sector[b].* At this stage, the GoA creates a pact with the private sector. This can be achieved by creating a registration platform where all organizations pledge to uphold specific principles determined by the GoA and the private sector. Moreover, the GoA can invest in specialized hubs such as webinars and seminars to share information and identify opportunities for the next stage. 2. *The active development of 21st-century (and digital) skills for Aruba[c].* At this stage, the GoA and the private sector aim to actively foster 21st-century (digital) skills for individuals and businesses. The goal at this stage is to update the current Aruban skills profile to be more in line with the top 10 skills for 2020 and 2025 (see Appendix A) and the four C's necessary for digital transformation. The GoA could also explore the possibility to promote the skills needed for the transition to the low carbon economy. The development of 21st-century skills could be achieved through, e.g., the creation of a dedicated proposal for vocational education and training and by creating dedicated courses on 21st-century skills at secondary schools. 3. *Supporting lifelong learning opportunities in Aruba[d].* At this stage, the GoA and the private sector could explore how lifelong learning for all can be stimulated. One possibility is the development of micro-credentials (i.e., short-phased [online] courses) in Aruba that focus on the development of 21st-century (digital) skills. Moreover, the GoA is recommended to advance 21st -century (digital) skills through the Directie Arbeid en Onderzoek (DAO). For example, the DAO can develop an online platform focusing on generalized 21st-century (digital) skills training through short videos. 4. *A framework towards investment in workforce 21st century (digital) skills[e].* The final stage involves the GoA creating an investment framework for 21st-century (digital) skills. In this way, the GoA prioritizes and allocates part of its budget to invest in 21st-century (digital) skills annually. Moreover, the GoA leads by example, encouraging the private sector to make periodic investments in its employees' abilities.

Implement the Digital Education Plan for Aruba[f]. The Digital Education Plan for Aruba adopts a similar framework to the Digital Education Action Plan of the European Commission. This plan is programmed for six years and is based on two areas/stages.

1. *The development of a digital education ecosystem for Aruba (primary and secondary education).* The first stage consists of the actual setup of a digital-inclusive education system for Aruba. Students would be exposed to digital tools from the start of their education. Moreover, the GoA is encouraged to allocate funds to acquire digital equipment and ensure high-quality connectivity in schools and homes. In addition, the GoA is encouraged to make internet connectivity affordable for under-privileged students.
2. *Enhancing digital skills for digital transformation.* The plan's second stage consists of the actual development of digital skills. Through the actions taken during the first stage, students would be exposed to digital tools from the start of their education. During the second stage, the GoA also would build (together with relevant stakeholders) a standard guideline for teachers with the goal of enhancing digital literacy.

Implement Collab4DigitalSkills[g] The Collab4DigitalSkills is a coalition involving the GoA and the private sector. This coalition is based on the original "Digital skills and jobs coalition" of the European Commission. The goal would be to foster digital skills in Aruba through a collaborative effort between the GoA and private institutions. In contrast to previous programs, actions are geared toward all members of the community: i) the citizens of Aruba in general, ii) the Aruban labor force participants, iii) ICT professionals, and iv) educators. The GoA could create a platform through which private-sector members are invited to join the coalition. During this process, the new members must demonstrate their commitment to helping advance digital skills in Aruba. This can include but is not limited to:

1. Providing coding classes for children
2. Providing online digital courses for educators
3. Providing specialized training for ICT specialists
4. Providing dedicated training for members of the unemployed population
5. Providing digital skills courses for the elderly

The Coalition between the Government of Aruba and the private sector has no specific end date.

	Measure the Digital Economy and Society Index for Aruba. The GoA is encouraged to calculate a baseline measurement for digital skills in Aruba. In addition, the GoA may continue measuring this index annually. The index will help in identifying those areas that require additional endeavors. In addition, the Future of Work – Digital Skills Survey could be repeated in the future to measure progress in the labor force. **Offer digital skills as a subject in primary, secondary, and tertiary education (alternative to the Digital Education Plan).** Digital skills training could be offered as a subject to primary and secondary students. Moreover, digital skills training should also be possible in tertiary education for students who did not have access to digital skills training in primary and secondary education. **Consult the European Commission for support.** The GoA is encouraged to consult the European Commission for support in implementing the programs mentioned above. **Improve the quality of internet services in Aruba.** The GoA and the national telecommunication provider should seek ways to improve the quality of internet services on the island. Addressing this issue will make it more feasible for businesses and individuals to take advantage of new digital technologies. **Lead by example.** The GoA should lead by example by taking digitalization initiatives. An example would be the implementation of the Aruba e-Government Road Map. **Increase the number of IT experts:** To date, the share of employed IT experts in the total labor force amounts to 0.2 percent. This number should be increased up to a minimum of 4.2 percent. The latter is in line with the labor force of Denmark. Denmark is considered to be a digital-savvy country according to the DESI 2022 and the World Digital Competitiveness Ranking 2022.
Digital skills (private sector)	**Update the 21st-century skills profile for the Aruban labor force.** Employers are encouraged to educate themselves on the 21st-century skills for 2020 and 2025, particularly the importance of the four C's.

	Provide frequent 21st-century employee training. Employers are recommended to provide 21st-century employee training, with a keen focus on developing the four C's. Another possibility is to offer micro-credentials. **Provide frequent digital skills training.** The private sector could also explore, e.g., the ICDL programs for their employees. **Prioritize the adoption of new digital technologies.**
	[a] The Aruban Skills Agenda is built on the European Skills Agenda. Therefore, the recommendations in this section are to some extent derived from the European Commission website: https://ec.europa.eu/social/main.jsp?catId=1223&langId=en [b] The suggestion is similar to the Pact for Skills of the European Commission. Further details of the original plan are provided on: https://ied.eu/blog/new-skills-agenda-for-europe-2020/ [c] The recommendations are based on the actions of the second building block of the European Skills Agenda. For more information, consult https://ec.europa.eu/social/main.jsp?catId=1223&langId=en [d] The suggestions are based on the actions of the third building block of the European Skills Agenda. For more information, consult: https://www.creativesoftskills.eu/eu-skills-agenda-2030/ and https://ec.europa.eu/social/main.jsp?catId=1223&langId=en [e] The recommendations are based on the action of the fourth building block of the European Skills Agenda. For more information, consult: https://ec.europa.eu/social/main.jsp?catId=1223&langId=en [f] The Digital Education Action Plan for Aruba is built on the Digital Education Action Plan of the European Commission. Therefore, the recommendations in this section are, to some extent, derived from the European Commission website: https://education.ec.europa.eu/focus-topics/digital-education/digital-education-action-plan [g] The Collab4DigitalSkills is built on the Digital skills and jobs coalition of the European Commission. Therefore, the recommendations in this section are, to some extent, derived from the European Commission website: https://digital-strategy.ec.europa.eu/en/policies/digital-skills-coalition

Table 3.7 Policy recommendations (tertiary education) – Future of Work

3.5. Conclusion

How can we secure the Future of work for Aruba by promoting inclusive and equitable tertiary education and advancing digital skills?

The first research question for this review was: "What is the interrelationship between (tertiary) education, digital skills, labor productivity, and the informal economy? How are they (causally) interrelated?" In this chapter, we describe how the elements are interrelated in theory. Specifically, tertiary education and the promotion of digital skills are believed to increase labor productivity and deter the informal economy. Meanwhile, the results of our correlation analyses showed a positive significant correlation between secondary education and labor productivity. This result is in line with the International Monetary Fund (2021) recommendation to promote secondary education enrollment as a measure to expand productivity. We also found a negative significant correlation between secondary education – informal employment and secondary education - informal economy. This finding is in line with existing research such as Gërxhani and Werfhorst (2013) who proved that education decreases informal sector participation. On the other hand, we found a significant negative correlation between tertiary education and labor productivity. Previous research such as Liu and Bi (2019) also found a similar negative relationship. This finding might indicate that Aruba's service-driven (tourism) economy and related labor productivity may not be readily and comprehensively affected by enrollment rates in tertiary education, in contrast to enrollments in secondary education. Nevertheless, the indicators used are not representative of actual graduates of tertiary education in Aruba. Moreover, there is a lack of long-run historical data on the indicators. Therefore, our results for the correlation analyses should not be over-interpreted.

With reference to the second research question, "How do we promote equitable and inclusive tertiary education for all in Aruba?" this chapter provides several recommendations for promoting enrollment and retention in tertiary education. The GoA – together with relevant partners – are recommended to identify the structural factors that lead to tertiary education dropouts in Aruba, implement a bridging program, encourage flexible and affordable tertiary education, and educate young people about the essence and importance of tertiary education. Moreover, the GoA is advised to promote private investments in tertiary education.

The third research question was "What is the current state of digital workforce skills? What measures can we take to foster digital skills among the Aruban labor force and general community?" The results of the Future of Work – Digital Skills Survey showed that the current skills profile of the Aruban labor force is outdated. As a result, the level of digital skills is not sufficient for digital transformation. The GoA and the private sector have several tools to strengthen digital skills in Aruba. For the GoA, these include but are not limited to "leading by example," implementing the Digital Education Plan for Aruba, and promoting the number of IT experts. Recommendations to the private sector include providing frequent training on 21st-century and digital skills. Importantly, employers are also encouraged to educate themselves on the 21st-century skills for 2020 and 2025, and particularly the importance of the four C's (communication, collaboration, critical thinking, and creativity).

This study is subject to several limitations. First, the lack of long-run historical data affects our analyses and results. In

addition, our survey only provided preliminary evidence since the results are likely not wholly representative of the business sector.

Future research should focus on creating and analyzing a baseline measurement for digital skills in Aruba (e.g., DESI). A survey similar to the Future of Work – Digital Skills Survey could also be repeated in the future. Moreover, there is a need for robust data on the completion (rate) for tertiary education. Future research could also analyze the avoidance of brain drain as a pathway to increase the portion of the population with a tertiary education degree. In addition, researchers are encouraged to investigate the link among tertiary education, digital skills, and wealth inequality. Finally, future research should explore disability inclusion (both visible and non-visible disabilities) in tertiary education in Aruba.

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Appendix A

Top 10 skills	
2020	2015
1. Complex problem solving	1. Complex problem solving
2. Critical thinking	2. Coordinating with others
3. Creativity	3. People management
4. People management	4. Critical thinking
5. Coordinating with others	5. Negotiation
6. Emotional intelligence	6. Quality control
7. Judgement and decision making	7. Service orientation
8. Service orientation	8. Judgment and decision making
9. Negotiation	9. Active listening
10. Cognitive flexibility	10. Creativity

Note. From the World Economic Forum, *Future of Jobs Report*

Top 15 skills for 2025
1. Analytical thinking and innovation
2. Active learning and learning strategies
3. Complex problem-solving
4. Critical thinking and analysis
5. Creativity, originality, and initiative
1. Leadership and social influence
7. Technology use, monitoring and control
8. Technology design and programming
9. Resilience, stress tolerance and flexibility
10. Reasoning, problem-solving and ideation
11. Emotional intelligence
12. Troubleshooting and user experience
13. Service orientation
14. System analysis and evaluation
15. Persuasion and negotiation
Note. From the World Economic Forum, *Future of Jobs Survey 2020*

Appendix B

Recommendations – Promotion of tertiary education	Estimated cost	Assumptions
Identify structural factors that lead to tertiary education dropouts in Aruba	Afl. 300 (once)	The study would be conducted through an online platform such as SurveyMonkey. We assume that no additional wage or execution costs would be incurred by the GoA.
Implement a bridging program	Afl. 2,200,000 (for a total duration of seven years)	The program implemented would be similar to the Romania Secondary Education Project (duration of seven years). The cost for GoA is estimated based on the total cost of ROSE. The latter would be adapted to the total population on Aruba.
Encourage flexible tertiary education	-	We assume that every tertiary education student has access to a computer device (i.e., a computer, laptop, or a tablet). We also assume that the introduction of part-time tertiary education programs will not increase expenditures of the GoA.
Tertiary education should be affordable	Afl. 6,500,000 (yearly)	Assuming a full subsidization of tertiary education tuition. This amounts to 0.1 percent of nominal GDP (2021).
Promote private investments in tertiary education	-	We assume that the GoA does not incur a cost in the elimination of red tape.
Educate young people about the essence of tertiary education	-	We assume that this process does not result in additional costs for the GoA

Recommendations – Promotion of digital skills	Estimated cost	Assumptions
Implement the Aruban Skills Agenda	Afl. 115,000,000 (for a total duration of five years)	The program implemented is similar to the European Skills Agenda (duration of five years). The cost for GoA is estimated based on the total cost of the European Skills Agenda. The latter is adapted to the total population on Aruba.
Implement the Digital Education Plan for Aruba	Afl. 18,000,000 (once)	We assume that each student in primary and secondary education will have access to a laptop at school.
Implement Collab4DigitalSkills	-	We assume that this process does not result in additional costs for the GoA.
Measure the Digital Economy and Society Index for Aruba	-	We assume that this process does not result in additional costs for the GoA. However, we cannot disregard costs related to technical assistances.
Offer digital skills as a subject in primary, secondary, and tertiary education (alternative to the Digital Education Plan)	-	We assume that the total teaching hours will remain unchanged. Therefore, we assume that this process does not result in additional costs for the GoA.
Consult the European Commission for support	-	We assume that this process does not result in additional costs for the GoA.
Improve the quality of internet services in Aruba.	-	We assume that this process does not result in additional costs for the GoA.
Lead by example	-	We assume that the costs related to the digitalization of the government are already included in GoA's multi-year budget. Our assumption is based on the e-Government road map (see: https://indd.adobe.com/view/dc915452-79d5-4c00-8667-9b0e56305b21)

Financial benefit		Assumptions
Tax revenue gain	Afl. 86,000,000 (yearly)	We assume that the informal economy is formalized. Our calculation is based on our estimation for the informal economy (9.1 percent) and the total tax revenue (Afl. 941.0 million) earned in 2021.

4.

Retail Digital Florin for Inclusive Resilience

Rynall Kock

Abstract

The aim of this chapter is to review the best implementation options for a retail central bank digital currency (CBDC), specifically a retail digital florin, using the minimum design criteria and implementation scheme. The minimum design criteria maximize the benefits and minimize the risks of a retail CBDC. This study ties the risks and benefits to inclusive resilience, which is associated with monetary stability, financial stability, financial inclusion, and financial integrity. On conclusion, an inclusively-resilient ***retail digital florin*** must at least exhibit: (i) a three-tiered know-your-customer (KYC) approach (to balance privacy and KYC efforts), (ii) offline features, (iii) one-to-one conversion between commercial bank deposits and CBDC, (iii) non-interest bearing, (iv) permissioned distributed ledger technology (DLT), (v) decentralized customer-facing activities, and (vi) for the time being, no cross-border payments.

Contingent on a proof-of-concept for a retail digital florin, the following implementation process needs to be followed. This policy paper partly meets the first step of the implementation process, as it proposes a (I) digital florin with the minimum design criteria, an input for assessing the feasibility of a retail CBDC. The second step (II) involves determining the terms and conditions for the regulatory sandbox. Within this step, the government would pass laws making the digital florin a legal tender. In the third step (III), the CBA announces the regulatory sandbox, and interested parties can start their innovation processes within the parameters of this sandbox. In the fourth step (IV), once the government finalizes the legislative changes to the Aruban Payments System Directive, consumer financial protection laws, and e-Commerce legal framework, the CBA can invite the regulatory sandbox partners to roll out their product after successful testing and “graduation” from the regulatory sandbox. In the last step (V), the government establishes an Aruba digital citizenship and e-Government platform so new use cases can be explored. Concurrently, CBA fosters new use cases within the existing regulatory sandbox and repeats the process.

Section 1. Introduction

Digital currencies currently garner significant attention from academia, policymakers, and central banks. Atlantic Council's (2022) central bank digital currency tracker[1] highlights this momentum. They show that as of May 2022, of the 111 countries surveyed – which covers over 95 percent of global output –, 97 are at least in the research stage of a CBDC (Figure 1). The number of countries in the research stage is a drastic increase compared to two years ago when only 35 countries were in the research stage.

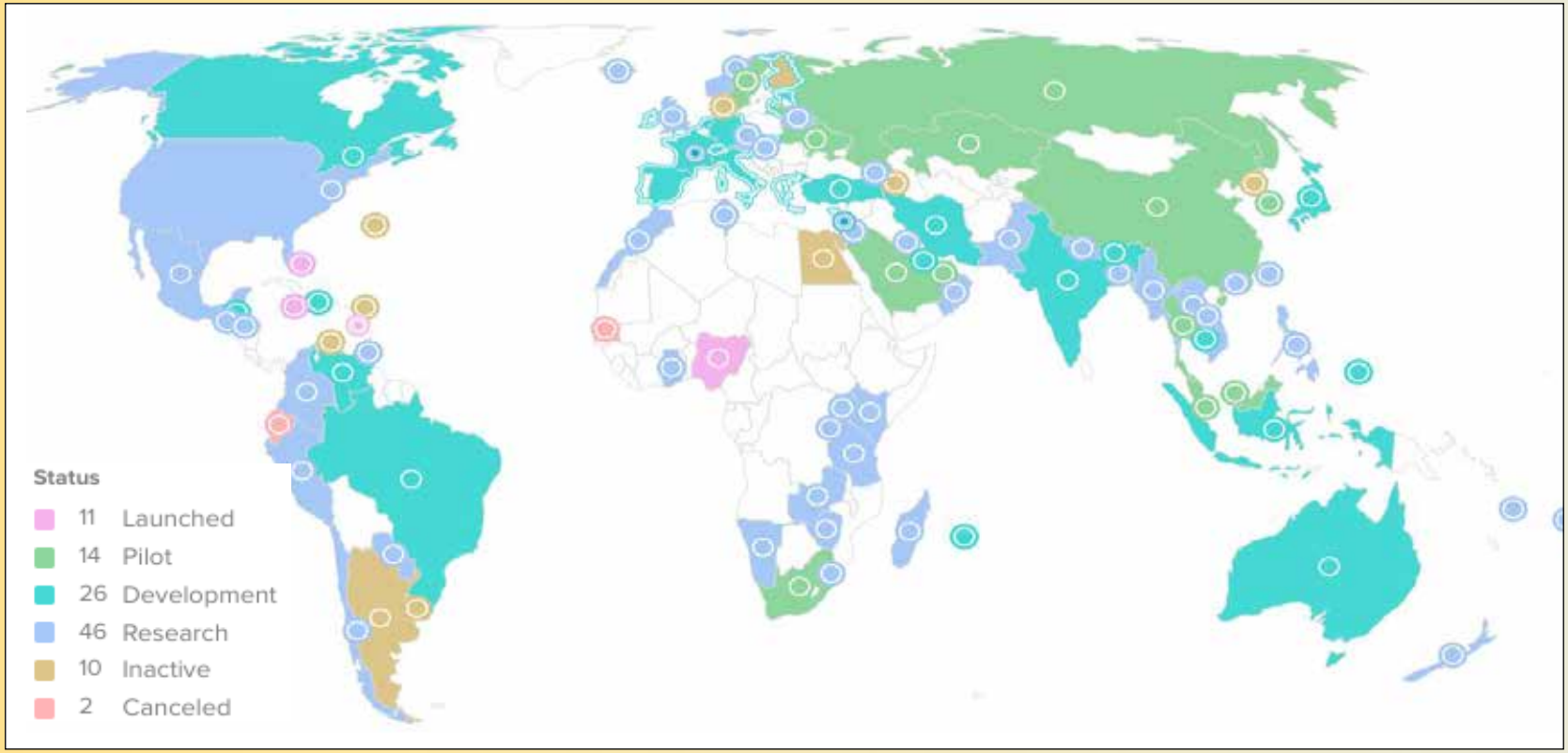


Figure 1: Stages of CBDC development by central banks worldwide (Atlantic Council, 2022).

[1] Consult the glossary for non-technical explanations of certain concepts.

According to a Bank for International Settlements (BIS) survey (Kosse and Mattei, 2022), this acceleration in exploring CBDCs stems from digital currencies affecting key central bank roles. The four prominent roles include safeguarding monetary stability, financial stability, financial integrity, and financial inclusion. For instance, for financial and monetary stability purposes, a retail CBDC can mitigate currency substitution by a cryptocurrency (BIS, 2021a). In terms of financial inclusion, a retail CBDC can push the transition from the unbanked to the banked (Kosse and Mattei, 2022). By shifting cash holdings to retail CBDC holdings, countries go against money laundering, counterfeiting, and other illicit activities (CBOB, 2022a).

These central bank roles are tightly connected with inclusive growth and resilience (Figure 2). For example, some studies argue that monetary stability facilitates inclusive growth (Aoyagi and Ganelli, 2015), and financial stability builds resilience (Damar and Molico, 2016; CBA, 2019a). Other studies show that financial integrity prompts resilience by limiting excessive risk-taking in the financial system (IMF, 2019b). Furthermore, financial inclusion promotes inclusive growth (Sahay et al., 2015a), which has implications for resilience (Iwata et al., 2017). Within the four major roles of central banks, there are also interdependencies. For instance, Mehrotra and Yetman (2015) show that financial inclusion impacts monetary and financial stability[2], which has implications for resilience (Iwata et al., 2017).

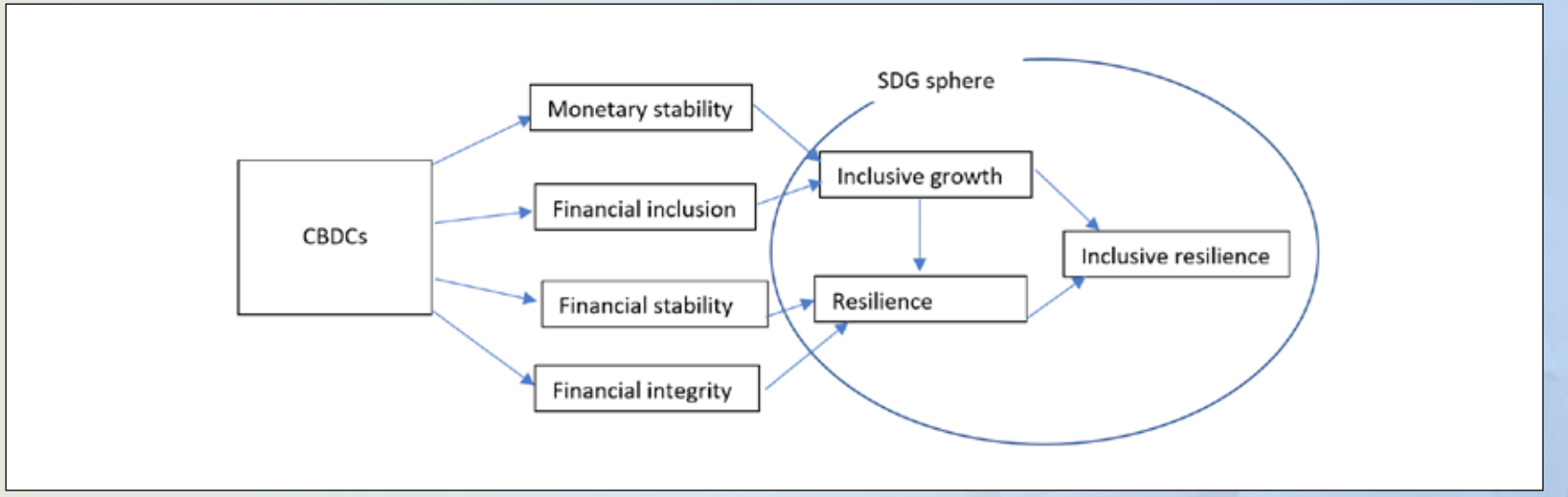


Figure 2: Conceptual framework of CBDCs and inclusive resilience.

[2] For readability, these interdependencies among the central bank roles have been left out in Figure 2.

Inclusive growth and resilience, in turn, reverberate through inclusive resilience. Namely, drawing inspiration from CBA (2019a), inclusive resilience is defined as the ability to withstand and adapt to shocks, thereby supporting economic growth for all social groups. Considering CBDCs' interconnectedness with inclusive resilience, the former should be high on the SDG agenda. The reason is that CBDCs provide a platform for innovation (SDG 9) (BIS, 2022a) and foment financial inclusion (Kosse and Mattei, 2022). The latter can advance gender equality (SDG 5), promote economic growth (SDG 8), and reduce inequalities (SDG 10) (refer to U.N., 2022).

In 2019, the Central Bank of Aruba (CBA) conducted a feasibility study on a local wholesale CBDC called the digital florin (CBA, 2019b). The main conclusion of this study is that a wholesale CBDC is feasible from a monetary, regulatory, institutional, and technical perspective, contingent on several stringent preconditions. However, when considering the salient characteristics of a retail CBDC, the associated risks may fall outside the CBA's risk appetite. Since that study focused on a wholesale CBDC, it is silent on whether risks related to a retail CBDC hold in the Aruban economic context or if a specific retail CBDC design can offset those risks. This chapter aims to fill these gaps in the literature, to then propose the minimum design criteria of a possible retail digital florin. That way, stakeholders have a better starting point to discuss a digital florin for Aruba.

The minimum design criteria of a retail digital florin are such that the proposed design maximizes the benefits and minimizes the risks. This policy paper views the risks and benefits through the lens of inclusive resilience, which is tied to monetary stability, financial stability, financial inclusion, and financial integrity. Accordingly, several features of the minimum design criteria are recommended. First, a three-tiered KYC approach (to balance privacy and KYC efforts) has the potential to reduce the ill effects of cash usage. This feature is relevant for financial integrity. Second, a retail CBDC must have attractive features to foster the transition from the unbanked to the banked, synonymous with financial inclusion. These attractive features are permissioned DLT (for smart contracts) and privacy recognition (to mimic the utility of cash and lower the entry barrier into the digital banking system). Moreover, offline abilities (to have an advantage over commercial bank money) and a one-to-one conversion between commercial bank deposits and CBDC (to be at least as attractive as commercial bank money) are other crucial aspects. Initial estimates show that these design options roughly yield a potential GDP gain of Afl. 107.1 million in 2019 terms. Third, this policy paper advises the CBA to decentralize the customer-facing duties (retail payments clearing, KYC checks), with the aim of fostering competition in the payments system. Competition can lower payment costs or diversify product choices. Nevertheless, Aruba's innovation capacity is constrained (CBA, 2022). Aruba can expand its innovation capacity if the government provides innovation complementarities (see Section 7 for definition and examples). Fourthly, a non-interest-bearing digital retail florin with a cap on holdings can reduce the likelihood of commercial bank disintermediation. Such a design reduces the risks of monetary and financial stability. Lastly, this policy paper advises to forgo cross-border payments as significant digital florin outflows may, in the future, lead to considerable foreign exchange outflows.

In what follows, Section 2 defines the four major roles of central banks that are affected by a retail CBDC. Section 3 makes the reader familiar with the world of CBDCs. Section 4

then explores the design considerations for a retail a CBDC. The theme of Section 5 is the theoretical pros and cons of a retail CBDC within inclusive resilience. Subsequently, Section 6 checks whether the pros and cons hold, given the Aruban economic context and specific retail CBDC design options. Given the net benefits, Section 7 provides policy recommendations. This chapter ends with a conclusion and discussion.

Section 2. Defining the four principal roles of central banks

This policy paper states that a retail CBDC affects four key central bank roles, as shown in Sections 4, 5, and 6. The four leading roles include safeguarding monetary stability, financial stability, financial integrity, and financial inclusion. Various studies (Aoyagi and Ganelli, 2015; Damar and Molico, 2016, IMF, 2019b; Sakyi-Nyarko, 2022) illustrate that these central bank roles touch inclusive resilience (Figure 2). The literature diverges in defining some central bank roles (for example, see Schinasi, 2004; Massara and Mialou, 2014). As such, this section describes the four leading central bank roles, i.e.,

I. **Financial stability:** Adapted from Schinasi (2004), a financial system is in a range of stability whenever it is capable of 1) facilitating economic growth and 2) neutralizing financial risks (stock price volatility, bank runs, among others).
II. **Monetary stability:** Monetary stability is synonymous with price stability or a low level of inflation (Issing, 2003).
III. **Financial inclusion:** Financial inclusion is individuals' access to and use of formal financial services (Sahay et al., 2015b).
IV. **Financial integrity:** A financial system is integral when a system operates cleanly (people do not direct money to illicit activities), transparent (asset ownership is known), and accountable (accountable return of stolen assets) (Transparency International, 2022).

Section 3. A primer on central bank digital currencies

CBDCs are a type of money. Policymakers must then interpret central bank digital currencies within the scope of money. The literature defines money in terms of its three main functions (BIS, 2022a). Money's function is (a) a medium of exchange (that is, to facilitate payments), (b) a unit value (i.e., to measure the value of exchanged goods and services in a standard way), and (c) a store value (or equivalently, money must hold its value over time).

How money fulfills its functions in practice rests on four main attributes (BIS, 2017). The first attribute splits money into a digital or physical form (Figure 3, blue oval). Cash, consisting of banknotes and coins, thus falls under physical money. Digital money, on the other hand, is created and stored electronically.

Within digital money, many variants exist. Among others, the issuer can be a central bank or a private issuer (Figure 3, green oval). This second feature of money distinguishes private digital tokens (such as cryptocurrency) from CBDCs. Thus, a CBDC is a digital money issued by a central bank.

Another characteristic of money is accessibility (Figure 3, red oval). Widely accessible money is available to the public, while narrowly accessible money is limited to a few parties. Applying this principle to a CBDC implies that a widely available - or retail CBDC involves low-value transactions between businesses and consumers. In contrast, a narrow - or wholesale CBDC concerns high-value transactions between, for example, commercial banks.

The verification method of money transactions relates to

the fourth attribute of money. In a CBDC, transactions can be at two extremes token verified or account verified (Figure 3, orange oval). A token-based CBDC relies on the payee's ability to validify the payer's payment object (in this case, the CBDC token). The verification of cash transactions is analogous to a token-based CBDC. In cash transactions, the payee only cares about the currency not being counterfeited; the payer's identity does not matter for verification. Tokens can be counterfeited, for example, when the payer sends the same token to two different transactions. On the other hand, an account-based CBDC pivots on one party's capacity to confirm the would-be payer's identity. The way commercial banks legitimatize transfers between clients would be similar to an account-based CBDC. By establishing the payer's identity, commercial banks deter misusers from unlawfully transferring funds from someone else's account to another account.

Section 4. Design considerations for a retail CBDC

The previous section splits money into four attributes to differentiate a retail CBDC from other types of money. Inside the boundaries of a retail CBDC, numerous design considerations stand out. These include whether a CBDC is a direct claim on a central bank (Auer and Böhme, 2020), caps on CBDC holdings (Kiff et al., 2020), offline features (Richards et al., 2020), and cross-border capabilities. Other design considerations are the interest-bearing aspect of a CBDC and how much privacy the central bank allows in CBDC transactions (Mancini-Griffoli et al., 2018). This section shows that those design options have bearings on inclusive resilience, as they affect financial stability, monetary stability, financial inclusion, and financial integrity (Table 1). The optimal retail CBDC design mix balances those four central bank roles (Section 6), given the risks and benefits of a retail CBDC outlined in Section 5.

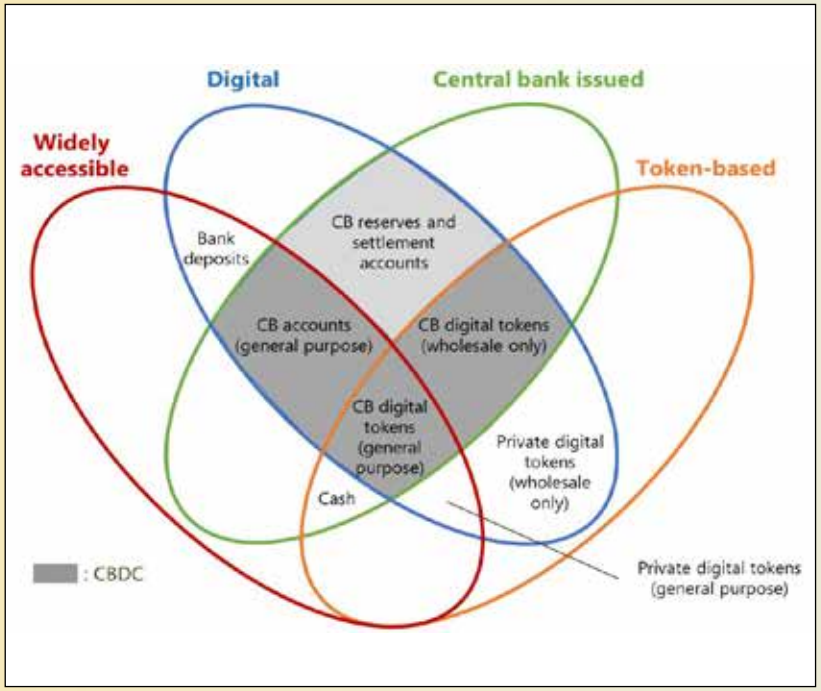


Figure 3: The taxonomy of money. Source: BIS (2017)

Dimension of inclusive resilience	Retail CBDC design features	Tradeoff	Source
Financial stability	Central or decentralized handling of retail payments	Less control of operations vs. disintermediation risks	Auer and Böhme (2020)
Financial stability, financial inclusion, and monetary stability	CBDC bases itself on permissionless DLT vs. centralized ledger	Resilience vs. scalability, governance, and oversight	Auer and Böhme (2020)
Financial stability, financial inclusion	Caps on CBDC holdings	Mitigation of disintermediation risks vs. useability	Kiff et al. (2020)
Financial inclusion, financial stability, financial integrity	Offline features for CBDC	Access to payments vs. constraints on holdings	Richards et al. (2020)
Financial inclusion, financial stability	CBDC has cross-border capabilities	Cheaper, faster payments vs. volatile capital flows	BIS (2022b)
Monetary stability, financial stability	CBDC bears interest	Interest-rate pass through stronger vs. disintermediation risks	Garratt et al. (2022)
Monetary stability, financial stability	CBDC backs itself against cash vs. central bank reserves	Less attractive for use vs. disintermediation risks	Kiff et al. (2020)
Financial integrity, financial inclusion	How much privacy do central banks allow	Privacy vs. AML/CFT gains	Mancini-Griffoli et al. (2018)

Table 1: Design considerations of a retail CBDC

Retail CBDC is an indirect or direct claim

A retail CBDC can represent a direct or indirect legal claim on the central bank (Auer and Böhme, 2020). If a CBCD forms a direct claim, and the central bank handles retail payments, Auer and Böhme (2020) call this arrangement a direct CBDC (Figure 4). Such a design offers more control in the operations process (Kiff et al., 2020). Nevertheless, a direct CBDC requires capacity and expertise building. The private sector is likely better suited for this undertaking (Kiff et al., 2020). In addition, electronic payments are vulnerable to connectivity issues involving risk-taking. Auer and Böhme (2020) argue that the private sector's experience with customer relationships allows it to take on such risks. Unless central banks are willing to take on customer due diligence (relevant for financial integrity) and other customer-facing activities, it would be difficult to imagine them offering these services. Moreover, if central banks start handling retail payments, they will compete with commercial banks. Such a scenario can entail disintermediation risks. Consequently, financial stability risks may arise as well.

In contrast, when a retail CBDC embodies an indirect claim on the central bank and the private sector manages retail payments, the literature classifies it as an indirect CBDC (Auer and Böhme, 2020) or synthetic CBDC (Adrian and Mancini-Griffoli, 2019). In this setting, the intermediary (marked "CBDC bank" in Figure 4) has to fully back each indirect CBDC liability (labeled "ICBDC" in Figure 4) to retail consumers against actual CBDCs deposited at the central bank. An advantage of this design is that the central banks relieve themselves of customer-facing duties. As such, the endeavor is cheaper and less risky (Adrian and Mancini-Griffoli, 2019). Furthermore, an indirect CBDC lets the private sector and the central bank maintain their comparative advantage. The former is in innovation and customer interactions, and the latter in providing trust and efficiency. However, if a private sector intermediary goes bankrupt, the central bank cannot honor consumer claims without information from the intermediary. Determining those entitled might involve lengthy and costly legal processes with uncertain outcomes (Auer and Böhme, 2020).

The hybrid CBDC is a middle ground between these two extremes. It is a direct liability of the central bank, but the private sector runs the retail payment system (Auer and Böhme, 2020). As an in-between, the hybrid CBDC balances the advantages and disadvantages of a direct and an indirect CBDC. The operational burden is less than under the direct CBDC, although more extensive than under the indirect CBDC. The private sector can then excel in innovation and customer handling. For financial stability, the central bank must be able to switch retail customer relationships from a failing payment service provider (PSP) to a fully functional PSP. Thus, central banks require the technical capacity and legal power to retain copies of retail balances periodically, and transfer retail CBDC balances from one failing PSP to another in the event of a technical failure.

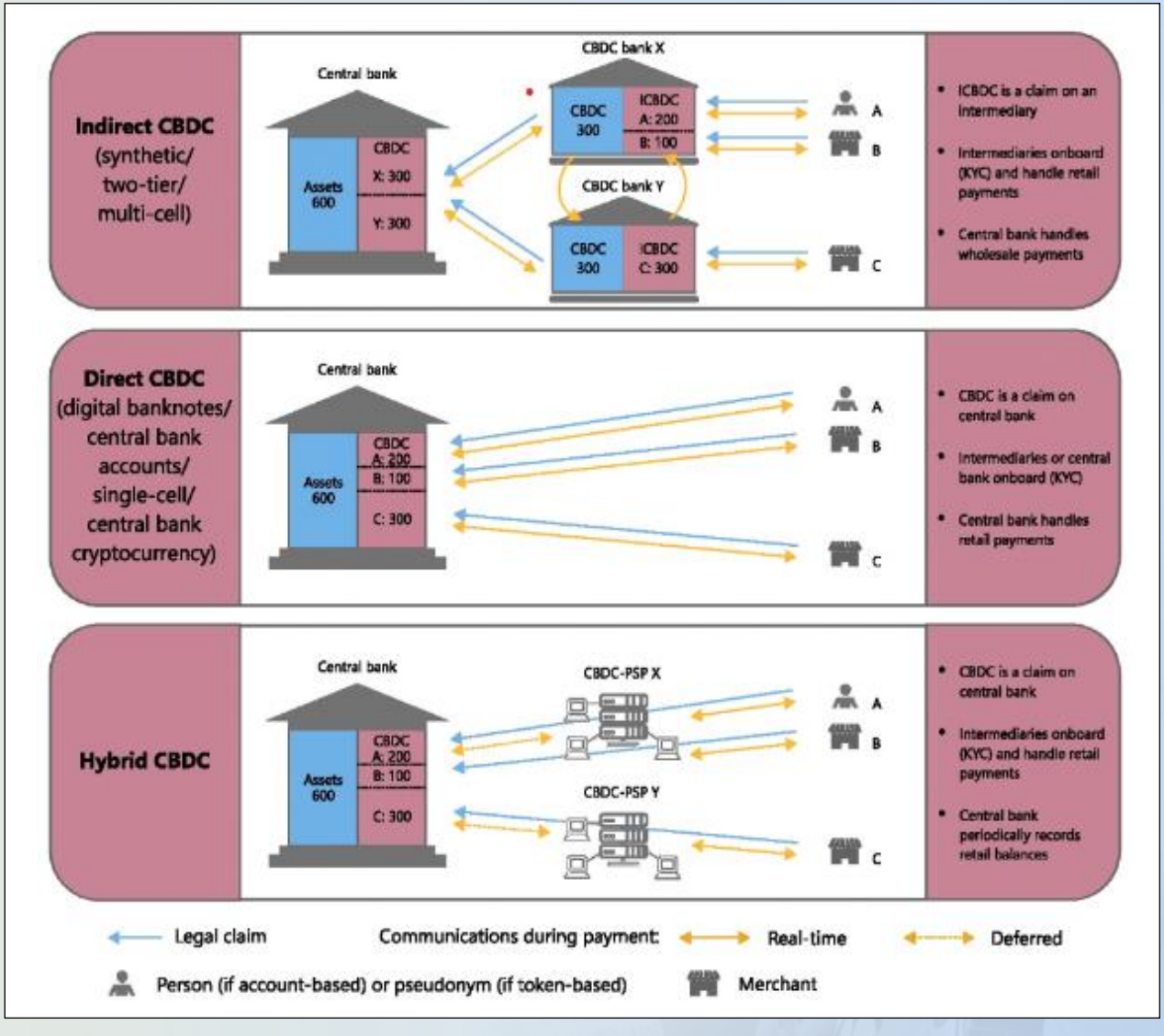


Figure 4: A retail CBDC can be direct or indirect on the central bank. Source: Auer and Böhme (2020)

A retail CBDC based on permissionless DLT ledgers vs. centralized ledgers

Central banks can choose how much to centralize the authority to update the retail transactions ledger (Auer and Böhme, 2020). In a fully decentralized fashion, permissionless distributed ledger technology (DLT) for a retail CBDC could provide resilience and smart contracts (BoE, 2020). However, the use of permissionless DLT for a retail CBDC lacks in terms of scalability, privacy, and security (BoE, 2020). In a permissionless DLT-based system, users initiate transactions, and miners compete to confirm those transactions in blocks before the blocks can be added to the general ledger (the blockchain). One block can only include a limited number of transactions. Accordingly, new users lead to more transactions, resulting in miners asking for higher transaction fees. Users who are willing to pay the fees get their transactions through. Those who are not willing have to wait. This phenomenon is the crux of the scalability problem (Dark et al. 2019), hurting its financial inclusion potential. Due to the lack of scalability, it appears unlikely that central banks would seriously consider a permissionless DLT platform for a CBDC (Richards et al., 2020).

DLT-based and centralized ledgers both store data multiple times and in physically separate locations. However, in centralized ledgers, there is one authority that updates the ledgers. In this arrangement, a vulnerability arises because if the central authority becomes compromised, this situation causes a system-wide downtime (Auer and Böhme, 2020)

A permissioned DLT-based platform, as an in-between, may be better suited for a retail CBDC. Access is restricted to PSPs, and a consensus mechanism is in place to achieve immediate, final, and irrevocable settlement. This design improves central banks' scalability, governance, and oversight (Kiff et al., 2020). In particular, central banks retain complete control over money issuance and monetary policy.

Caps on retail CBDC holdings

Many retail CBDC pilots instill a cap on CBDC holdings and transaction sizes (Kiff et al., 2020). This design is in mind to keep the retail CBDC as similar to cash as possible. In doing so, central banks attenuate disintermediation risks and maintain financial stability. For instance, the Central Bank of Bahamas limits retail holdings of the sand dollar to ensure that it does not become a substitute for banking deposits (CBOB, 2019). Such a design possibly prevents high-value transactions from happening, making it less attractive for adoption. Against this background, Bindseil (2020) suggests a "waterfall" concept. Concretely, payments that push holdings over the cap would automatically transfer to a commercial bank account connected with the CBDC wallet. The sand dollar utilizes this concept. Besides mitigating intermediation risks, ceilings on CBDC holdings can propel financial inclusion. Notably, individuals can obtain sand dollar wallets without needing a bank account at the expense of limited wallet size and functionalities (CBOB, 2019). The intention hereof is to balance know-your-customer (KYC) principles (for financial integrity) and financial inclusion.

Offline features for a retail CBDC

Central banks can design a retail CBDC to keep the payments system running in the face of electricity and telecommunications disruptions (Richards et al., 2020). Central banks can build a CBDC that operates (at least temporarily) in an

offline mode. Such a design would provide resilience when network disruptions or power outages occur. As a result, the private sector can maintain activities conducive to economic growth, benefiting financial stability (Schinasi, 2004). Furthermore, this design helps financial inclusion through access to financial services (Sahay, 2015b). Richards et al. (2020) envision a hybrid retail CBDC based on token and account verification. Specifically, people use their mobile wallets to exchange tokens offline without needing a central party. Periodically, the mobile wallets connect to the central ledger to verify identities, record transactions, and reconcile balances. This feature allows the authorities to detect counterfeit tokens and, potentially, restore value if a user loses their mobile wallet. Relevant to financial integrity, a CBDC issued in this form would probably comprise transaction limits to ensure compliance with AML/CTF rules (Richards et al., 2020).

An interest-bearing retail CBDC

If central banks choose to remunerate their retail CBDC, it can strengthen the pass-through of policy rates to lending rates (Garratt et al., 2022). A high enough interest rate on CBDC holdings can make other commercial bank deposits relatively less attractive. As such, commercial banks may have to raise their interest rates on deposits. But to maintain their profit margin, the interest rate on lending would need to follow suit, enhancing the monetary policy pass-through. How much CBDCs drain from commercial bank deposits depends, among others, on the remuneration. Garratt et al. (2022) argue that smaller banks have less space to raise deposit interest rates than larger banks. Therefore, small commercial banks may rely more on wholesale funding (instead of retail funding). This scenario exemplifies a firmer monetary policy pass-through again. However, the higher cost of funding and commercial bank deposit drainage possibly raise financial stability concerns (BIS, 2021a).

A retail CBDC with cross-border capabilities

Central banks' decisions on who (and how people) can access their retail CBDCs dictate cross-border capabilities (BIS, 2022b). Cross-border payments are payments between a resident and a non-resident. Often, these payments coincide with cross-currency payments. However, this does not need to be the case. Payments within monetary unions, for instance, are cross-border but not cross-currency (Bech et al., 2020). There exists a continuum along which non-residents can access a resident CBDC. In the most permissive case, central banks grant CBDC access to resident branches of foreign corporates or ex-pats living abroad for remittances. In a less lenient case, only tourists can make payments within the country visited. Central banks prohibiting CBDC access to non-residents represents the most restrictive case. Another consideration worth contemplating is that if a retail CBDC is token-based, foreign residents will, by default, have access to it (Auer and Böhme, 2020).

Cross-border arrangements for retail CBDCs imply similar costs and benefits of greater financial integration (BIS, 2021b). First, retail investors and remittance senders gain from cheaper and more accessible options. This advantage touches on financial inclusion. Second, markets become more integrated, enabling investment and risk-sharing opportunities. However, this may come at the cost of increased contagion risks and volatile cross-border capital flows (BIS, 2021b).

Issue retail CBDC against cash vs. central bank reserves

Central banks can issue a retail CBDC against existing cash or central bank reserves (Kiff et al., 2020). This decision has mixed

implications for central and commercial banks' balance sheet sizes. If central banks issue CBDCs against cash, their balance sheet size remains the same as there is merely a composition change within liabilities from cash to CBDC (Figure 5a). This outcome would also hold for commercial banks on the asset side.

Nevertheless, the impact is heterogenous when central banks issue CBDCs against central bank reserves, which will be the case if households and firms exchange deposits for CBDC (Kiff et al., 2020). In this case, a central bank's balance sheet size would not vary since it substitutes central bank reserves with CBDC. However, commercial banks lose both deposits (a liability) and central bank reserves (an asset), shrinking their balance sheet (Figure 5b).

Commercial banks may turn to wholesale funding to maintain their desired level of central bank reserves, prompting interest rate increases on deposits (Kosse and Mattei, 2022). To counteract this development, central banks can inject liquidity in the banking system by buying securities from the public (Malloy et al., 2022) (Figure 6). For the central bank, the risk profile of its balance sheet may change (Richards et al., 2020). It also becomes more influential in determining market interest rates as commercial banks become more dependent on wholesale funding (Kiff et al., 2020). So, these circumstances affect monetary stability. Furthermore, the higher funding costs may lead to lower commercial bank profitability, imperiling financial stability (Mancini-Griffoli et al., 2018).

An initial solution would be blocking convertibility between commercial bank deposits and CBDC. Nonetheless, skipping convertibility will likely make the CBDC less appealing to users (Bindseil, 2020), limiting financial inclusion. Furthermore, there are less intrusive ways of mitigating disintermediation risks, such as holding limits and tiered remuneration (Kiff et al., 2020).

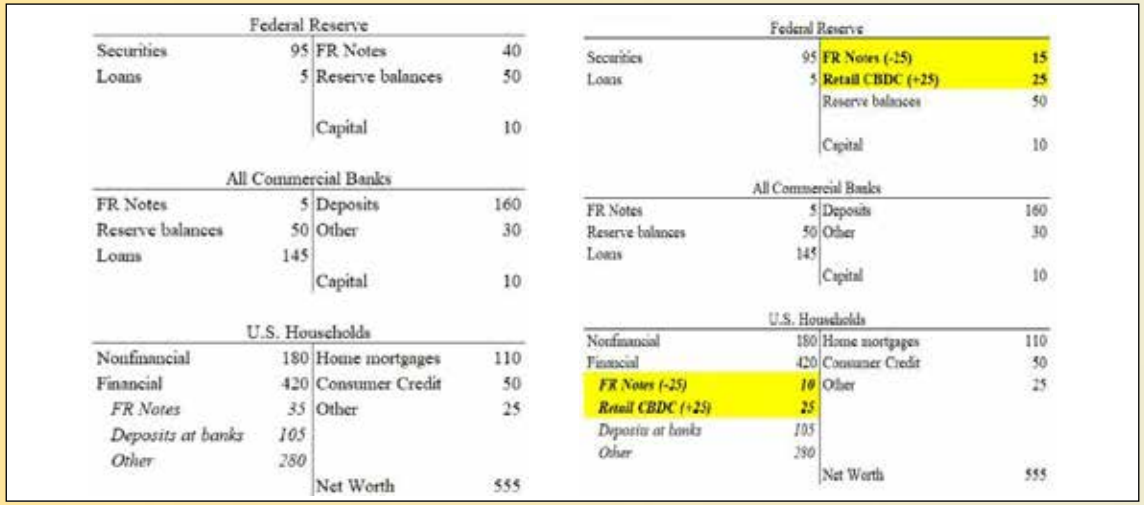
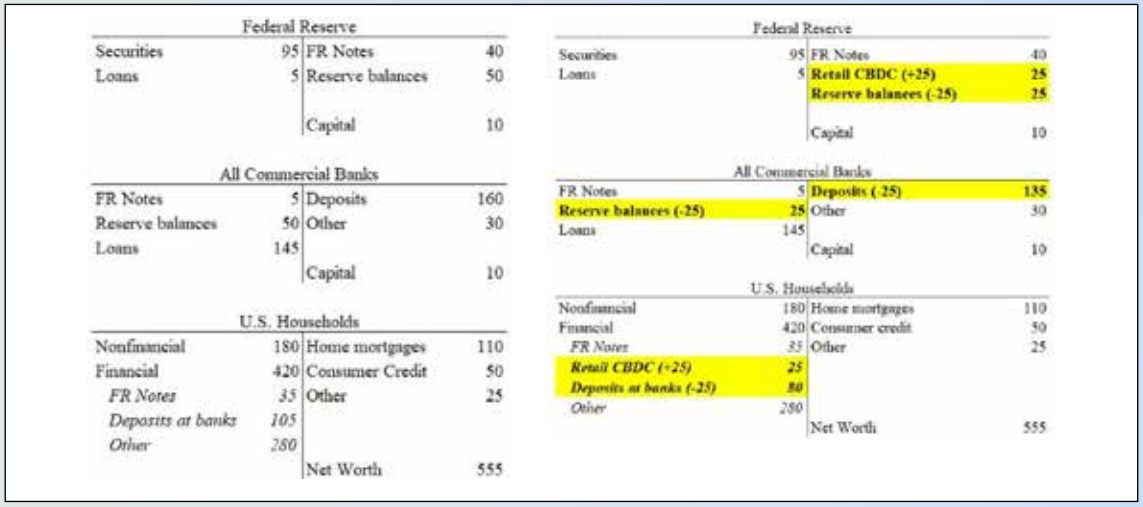


Figure 5a: Balance sheet before and after households withdraw CBDC against existing cash or central bank reserves. Source: Malloy et al. (2022)



Federal Reserve			
Securities	95	FR Notes	40
Loans	5	Reserve balances	50
		Capital	10

All Commercial Banks			
FR Notes	5	Deposits	160
Reserve balances	50	Other	30
Loans	145		
		Capital	10

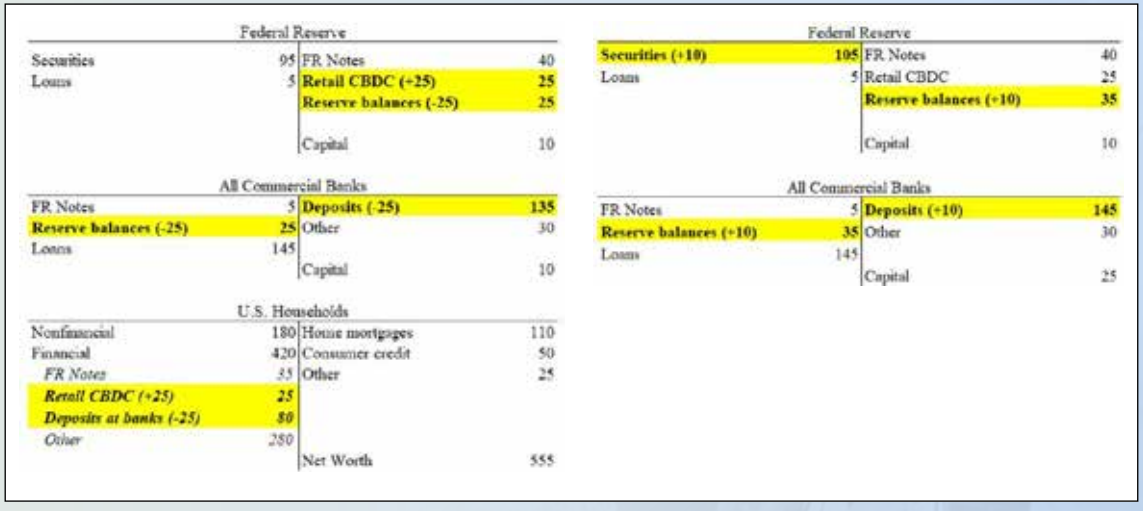
U.S. Households			
Nonfinancial	180	Home mortgages	110
Financial	420	Consumer Credit	50
FR Notes	*35*	Other	25
Deposits at banks	*105*		
Other	*280*		
		Net Worth	555

Federal Reserve			
Securities	95	FR Notes	40
Loans	5	**Retail CBDC (+25)**	**25**
		Reserve balances (-25)	**25**
		Capital	10

All Commercial Banks			
FR Notes	5	**Deposits (-25)**	**135**
Reserve balances (-25)	**25**	Other	30
Loans	145		
		Capital	10

U.S. Households			
Nonfinancial	180	Home mortgages	110
Financial	420	Consumer credit	50
FR Notes	*35*	Other	25
Retail CBDC (+25)	***25***		
Deposits at banks (-25)	***80***		
Other	*280*		
		Net Worth	555

Figure 5b: Balance sheet before and after households withdraw CBDC against central bank reserves. Source: Malloy et al. (2022)



Federal Reserve			
Securities	95	FR Notes	40
Loans	5	**Retail CBDC (+25)**	**25**
		Reserve balances (-25)	**25**
		Capital	10

All Commercial Banks			
FR Notes	5	**Deposits (-25)**	**135**
Reserve balances (-25)	**25**	Other	30
Loans	145		
		Capital	10

U.S. Households			
Nonfinancial	180	Home mortgages	110
Financial	420	Consumer credit	50
FR Notes	*35*	Other	25
Retail CBDC (+25)	***25***		
Deposits at banks (-25)	***80***		
Other	*280*		
		Net Worth	555

Federal Reserve			
Securities (+10)	**105**	FR Notes	40
Loans	5	Retail CBDC	25
		Reserve balances (+10)	**35**
		Capital	10

All Commercial Banks			
FR Notes	5	**Deposits (+10)**	**145**
Reserve balances (+10)	**35**	Other	30
Loans	145		
		Capital	25

Figure 6: Balance sheet after households withdraw CBDC and in reaction to that, the central bank buys securities from non-banks. Source: Malloy et al. (2022).

Retail CBDC tradeoff between financial integrity and privacy

There is an inherent tradeoff between financial integrity and privacy in retail CBDC transactions (Mancini-Griffoli et al., 2018). On the one hand, a CBDC completely geared towards financial integrity is one in which relevant authorities can gather identity and transaction data from CBDC transactions. Conversely, a CBDC that guarantees privacy makes disclosing the identities of CBDC transactions impossible. These two extremes have advantages and disadvantages. A CBDC that assures financial integrity helps anti-money laundering and counter-terrorism financing. At the same time, such a CBDC design potentially discourages adoption by users who legitimately seek some privacy, decelerating financial inclusion.

Further, CBDCs that require complete identification might impede those without identity documents from entering the formal financial sector. This outturn again hampers financial inclusion. The opposite holds for a CBDC that prioritizes privacy. Such a design can propel financial inclusion. However, financial integrity is at risk; arguably more so than cash, as digital money is easier to move around, especially if there are uncontrolled cross-border capabilities.

Section 5. Theoretical considerations for a retail CBDC

5.1 Benefits

There are multiple theoretical benefits of a retail CBDC (Table 2). These include bringing a competitor for crypto (Kosse and Matteit, 2022; BIS, 2021), helping cashless economies (Riksbank, 2022), payment resilience (BoC; 2022), transitioning the unbanked to the banked (Barontini and Holden, 2019). Other theoretical benefits include promoting competition in payments (FED, 2022), cheaper and faster payments (Mancini-Griffoli et al., 2018), and adaptability to dynamic consumer needs (BIS 2022a). This section demonstrates that the theoretical benefits can affect financial stability, monetary stability, financial inclusion, and financial integrity. These four dimensions, in the end, shape inclusive resilience (Section 2). As discussed in Section 6, not all the benefits hold in the Aruban economic context.

Dimension of inclusive resilience	Benefits	Source
Financial stability	Retail CBDC is a competitor for crypto	Kosse and Mattei (2022)
	Retail CBDC benefits cashless economies	Riksbank (2022)
	Payment resilience	BoC (2022)
Monetary stability	Retail CBDC is a competitor for crypto	BIS (2021)
Financial inclusion	The transition from unbanked to banked	Barontini and Holden (2019)
	Cheaper and faster payments	Mancini-Griffoli et al. (2018)
	Adaptability to dynamic consumer needs	BIS (2022a)
Financial integrity	Reduce ill effects of cash usage	CBOB (2019)

Table 2: Benefits of a retail CBDC

Financial stability – Retail CBDC is a competitor for crypto

Kosse and Mattei (2022) underscore that stablecoins rose in popularity, yet they alarmingly cannot meet the three functions of money[3]. Stablecoins initially promised to be a store of value by having lower price volatility than other cryptocurrencies. However, TerraUSD imploded in May 2022, with its value dropping from USD 1 to just a few cents in a few days (BIS, 2022a). If there were widespread adoption, the balance sheets of households and firms would deteriorate, endangering financial systems. Currency substitution may also compromise financial stability because a central bank cannot act as a lender of last resort when a stablecoin faces significant selling pressure (G7, 2019). By providing access to an attractive (digital) currency, central banks can reduce the likelihood that other currencies will sway public adoption (BIS, 2022a).

Financial stability – A retail CBDC benefits cashless economies

The Riksbank sees financial stability risks in a cashless economy and identifies a retail CBDC as a potential solution to that issue (Riksbank, 2022). Engert et al. (2019) lay out how a CBDC could aid a cashless environment. In a cashless setting, households would lose access to money directly backed by the central bank, a trusted public institution. Such exposure would be troublesome in Aruba, as retail bank deposits are not yet insulated from loss by a deposit insurance scheme[4]. Although central banks indirectly back retail bank deposits – because of the guaranteed one-to-one conversion between commercial bank money and central bank money – there could still be circumstances under which households contemplate the safety of their deposits (BoC, 2020). For instance, when people are unaware of such safety measures (Armelius et al., 2020). In short, a retail CBDC offers people another type of money backed by a trusted entity. et al., 2020).

Financial stability – Payment resilience

A retail CBDC can add resilience to the payment system (Richards et al., 2020). For a CBDC to improve payment system resilience, CBDC payment services would have to be provided to retail users via different platforms and technologies to those currently used by banks and other PSPs. Another condition is that a retail CBDC must keep the payment system running when network failures or power outages occur. A retail CBDC can meet this condition by having offline features to a retail CBDC (BoC, 2022). Offline features can help overcome payment system disruptions, and maintain economic activity, thereby contributing to financial stability (Schinasi, 2004).

Monetary stability – Retail CBDC is a competitor for crypto

Within the scope of monetary stability, central banks began considering retail CBDCs because stablecoins potentially substitute money issued by commercial banks and central banks (BIS, 2021). Such a scenario is risky because

[3] As explained previously, money's function is a medium of exchange, a unit of account, and a store value.

[4] In December 2021, the legal basis to introduce a DIS was adopted by Parliament through an amendment of the State Ordinance on the Supervision of the Credit System (AB 1998 no. 16). The draft state decree regulating the DIS is in the legislative process at the moment of writing.

a domestic central bank has little influence on the interest rate on stablecoins deposits backed by a foreign currency, if legally allowed. Thus, the wealth effect of monetary policy diminishes (G7, 2019). Additionally, the savings and investment channel can dilute if the private sector can freely switch between stablecoin and domestic currency deposits (G7, 2019). Furthermore, the exchange rate channel likely weakens if international trade becomes widely denominated in stablecoin currencies. Concretely, the terms of trade would rely on the exchange rate between the stablecoin and the domestic currency, not on the exchange rate between the domestic and foreign currency.

Financial inclusion – Transition from the unbanked to banked

One main argument for a retail CBDC is financial inclusion by advancing the transition from the unbanked to the banked (Barontini and Holden, 2019). The unbanked or underbanked are usually already disadvantaged in other areas, such as a lack of legal status, a low-income level, or disability (Engert et al., 2019). By introducing a CBDC with low entry barriers and tiered level accounts[5], central banks can strike a balance between financial inclusion and KYC principles.

Financial inclusion – Cheaper and faster payments

Retail CBDCs can stimulate competition in the domestic payments landscape (FED, 2022), especially if central banks allow FinTech companies to offer payment services. Increased domestic competition can then lead to cheaper and faster electronic payments (Mancini-Griffoli et al., 2018), lowering the barriers to financial inclusion (Ahmad et al., 2020). Moreover, digital electronic payments no longer have natural competition if cash disappears from the economy. Adverse effects emerge, in which a few payment service providers (usually commercial banks) dominate the retail payment system (BoC, 2022), thereby likely causing higher transaction fees and fewer product choices. As a potential remedy, introducing a retail CBDC can increase competition. Regarding international payments, cross-border CBDCs would coexist with other cross-border payment methods. As such, payment diversity improves, leading possibly to more competition and efficiency (BIS, 2022b). Furthermore, cross-border CBDCs can be cheaper and faster than current ones, given the long chains of correspondent banking and unstandardized messaging protocols (BIS, 2022b).

Financial inclusion – Responsive to consumer needs

Competition can motivate businesses to be more attuned to dynamic consumer needs (BIS, 2022a). Mazer and Rowan (2016) note that a competitive ecosystem catalyzes the quality and diversity of mobile financial services products, pushing the demand for such services, and promoting financial inclusion. For example, some suggest the introduction of a retail CBDC because of the payment innovations associated with DLT (Richards et al., 2020). The emphasis here has been on enabling smart money. Smart money involves making payments conditional on various events or characteristics (through smart contracts), automatically triggering the immediate payment of taxes associated with specific transactions. Note that these potential gains hinge on country-specific characteristics, such as the amount of competition already in the payment system and a country's innovation capability (CBA 2022, Chapter 7).

[5] More disclosure of customer information allows customers a higher spending limit on their digital wallet.

Financial integrity – Lessen ill effects of cash usage

Reduced cash usage, along with increased financial transaction monitoring, would enhance national defenses against money laundering, terrorist funding, and other illicit activities (CBOB, 2019). Such an outcome would also benefit national risk assessments, easing access to correspondent banking arrangements. This effect would then presumably affect financial inclusion in cross-border payments. In addition, compared to electronic payments, cash bears physical security risks to people and businesses and increases their vulnerability to fraudulent losses.

5.2 Risks

There are multiple (theoretical) risks of a retail CBDC (Table 3). These risks comprise commercial bank disintermediation (BIS, 2018), worsened bank runs (BIS, 2018), cybersecurity (FED, 2022), and privacy concerns (Mancini-Griffoli et al., 2018). This section discusses how these theoretical risks impact financial stability, monetary stability, financial inclusion, and financial integrity. These four dimensions ultimately contour inclusive resilience (Section 2). As shown in Section 6, not all the benefits hold in the Aruban economic context or can be mitigated by a CBDC design.

Dimension of inclusive resilience	Risk	Source
Financial stability	Commercial bank disintermediation	BIS (2018)
	Worsened bank runs	BIS (2021a)
	Cybersecurity risks	FED (2022)
Monetary stability	Commercial bank disintermediation	FED (2022)

Table 3: Theoretical risks of a retail CBDC

Financial stability – Commercial bank disintermediation

A retail CBDC can yield financial stability risks (BIS, 2018). Depending on the CBDC design (interest-bearing or not, e.g.) and country-specific characteristics (for example, openness to new technology), commercial banks funded mainly by retail deposits may face competition from a CBDC. Consequently, commercial banks may raise interest rates on deposits to attract new deposits. In reaction to the higher cost of funding, commercial banks may turn to higher interest rates on loans. However, this action may come at the expense of lower loan demand and, thus, profitability. Alternatively, they may resort to liquidating assets or borrowing from other banks. These actions entail a higher cost of funding and, depending on market power, repercussions for profitability (Mancini-Griffoli et al., 2018). In such a scenario, central banks need to consider financial stability.

Financial stability – Worsened bank runs

Depending on the supply of CBDC, another financial stability risk is that a retail CBDC could worsen bank runs, as people can convert commercial bank money more quickly into CBDC than cash (BIS, 2021). Currently, if customers become concerned about their deposits at a particular bank, they can transfer their funds to another bank or withdraw cash at branches and ATMs. Regarding the latter, there are practical limitations on how much people can withdraw through ATMs and branches. In the presence of a CBDC, however, a run on the banking system would be easier (Fed, 2022). Notably, people can make large-scale transfers from commercial bank deposits to CBDC. This risk, again, is contingent on the design of the CBDC and trust in the financial system (a country-specific characteristic).

Financial stability – Cybersecurity risks

Like other payment services, a retail CBDC can be exposed to cybersecurity threats and operational disruptions (FED, 2022), affecting financial stability. Ranging from the human layer to the hardware layer, attackers can exploit different layers of a CBDC to achieve their goals (Fanti et al., 2022), called the CBDC stack (Figure 7). Further, users, third parties, and system insiders have varying access to the CBDC layers, creating an attack matrix. Note that the layers are not independent. That is, attackers can attack multiple layers simultaneously.

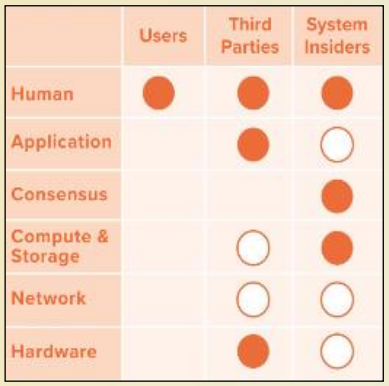


Figure 7: Attack matrix of a CBDC. Filled circles imply full potential access. Empty circles indicate possible partial access. Source: Adapted from Fanti et al. (2022).

Users can attack the human layer of a CBDC (Fanti et al., 2022). Users' ability to influence the internal layer of the CBDC stack is oftentimes limited. In general, users can only access and abuse software to the extent that they can control other users. Fraud and money laundering are two examples of relevant attacks, indicating that users can be both perpetrators and victims.

Third parties have access to the human, application, and hardware layers of a CBDC (Fanti et al., 2022). As such, they are often more dangerous than normal end users since they have greater resources to attack the CBDC layers of a CBDC. Third parties consist of scammers, application developers, and hardware manufacturers. The following two paragraphs will focus on the application and hardware layers, as the previous paragraph already dealt with the human layer.

Because application developers are sometimes independent of device manufacturers, it may be challenging to regulate

application security standards. Developers can intentionally or unintentionally expose vulnerabilities that attackers can exploit to steal money or exfiltrate data. While one cannot directly link application-level threats to the CBDC, they can impact the CBDC's overall viability.

CBDCs will run on hardware, including mobile devices, hardware wallets, and servers that maintain the system's operations. Consequently, insecure firmware or vulnerabilities hard coded into the hardware (e.g., backdoors in a hardware wallet) form potential sources of a security breach.

System insiders have access to the CBDC layers related to users, computation and storage, and consensus (Fanti et al., 2022). They refer to individuals who have access to the internal operations of a CBDC, including CBDC database operators or CBDC developers. Therefore, insiders are notoriously difficult to defend against. The following two paragraphs stress the vulnerabilities of the CBDC layers related to computation and storage, as well as consensus.

CBDCs require computation and storage to maintain a secure and functional payment system. System insiders can attack internal or external (cloud) servers and databases (Kiff et al., 2020). In the cloud arrangement, the central bank exposes itself to the vulnerabilities of its partners. The shared vulnerability can potentially jeopardize the ledger's integrity and result in theft or the CBDC operation going offline.

Most DLT CBDC systems use consensus protocols to accomplish immediate, final, and irreversible transaction settlement (refer to glossary). In consensus protocols, there are different transaction validators. These validators stretch from multiple banks hosting validator nodes or central-bank-managed servers on various data centers. The Swedish e-krona, for example, employs DLT and lets banks run their own payment validator nodes. Consensus protocol attacks generally entail the corruption of one or more transaction validators.

Third parties and system insiders can potentially get partial access to the CBDC network (Fanti et al., 2022). The CBDC network communicates validated transactions and issues CBDC to relevant parties via a network. This network relies on a closed infrastructure to communicate changes among payment validators. Meanwhile, account providers and end users interact on the public Internet. These networks are susceptible to denial-of-service attacks, and for the DLT case, censorship attacks or partitioning attacks (see glossary).

Monetary stability – Commercial bank disintermediation

A CBDC also has bearings on monetary stability. If consumers prefer a CBDC over commercial bank deposits, the deposit base of commercial banks may erode. This scenario entails a cost of funding increase and affects the credit supply (FED, 2022). Hence, monetary stability considerations then come into play. Furthermore, if the deposit base retrenches and commercial banks borrow from the central bank, then monetary stability is again affected. The impact on monetary stability ultimately rests on the demand for commercial bank deposits (a country-specific characteristic) and how much CBDC people can hold at any time (a design option).

Section 6. Assessing the risks and benefits of a retail CBDC

The previous section displayed the theoretical pros and cons of a retail CBDC. However, this section posits that the benefits and risks are conditional on the economic context and the retail CBDC design. Table 5 summarizes the findings.

Dimension of inclusive resilience	**Impact** / **Likelihood**	Small	Medium	Large
Financial stability	Unlikely			Retail CBDC competes with crypto. Retail CBDC benefits cashless economies. Commercial bank disintermediation (caps on holdings, not remunerated). Worsened bank runs (caps on holdings).
	Possible		Payment resilience (offline features). Cybersecurity risks (privacy).	
	Likely			
Monetary stability	Unlikely			Retail CBDC is a competitor for crypto. Commercial bank disintermediation (caps on holdings, not remunerated).
	Possible			
	Likely			

Table 5 (continued)

Financial inclusion	Unlikely			
	Possible		The transition from unbanked to banked (permissioned DLT, offline features, privacy recognition). Adaptability to dynamic consumer needs (indirect or hybrid CBDC).	Cheaper and faster payments. Domestic, no. Cross-border, yes, but significant conflicting risk.
	Likely			
Financial integrity	Unlikely			
	Possible		Reduce ill effects of cash usage (tiered account in which different KYC and privacy standards apply)	
	Likely			

Table 5: Assessing the risks and benefits of a retail CBDC. Benefits in light green, risks in light orange. The parentheses indicate that the risk or benefit is conditional on certain CBDC design options.

6.1 Benefits

Financial stability and monetary stability – Competitor for cryptocurrencies

As discussed in Section 5.1, if people increasingly switch to cryptocurrencies, central banks cannot use their lender-of-resort ability. Furthermore, such a switch weakens the transmission channels of monetary policy, for example, the wealth channel, and the savings and investments channel. Against this background of financial and monetary stability risks, central banks began considering a retail CBDC to mitigate the widespread adoption of cryptocurrencies. However, widespread adoption does not hold in the economic context of Aruba. After all, the 2022Q2 consumer confidence survey (CCS) data show that only 8.0 percent of respondents hold Bitcoin (Figure, 8). Note that holding does not imply domestic payments, as Bitcoin is not legal tender in Aruba.

In contrast, in El Salvador, bitcoin is legal tender. In that country, three million people have downloaded the Chivo bitcoin wallet – the government-sponsored bitcoin wallet – with a conversion rate of 46 percent (Pineda and Renteria, 2021). Given the conversion rates in El Salvador, the argument for a competitor for cryptocurrencies may hold, but less so in Aruba.

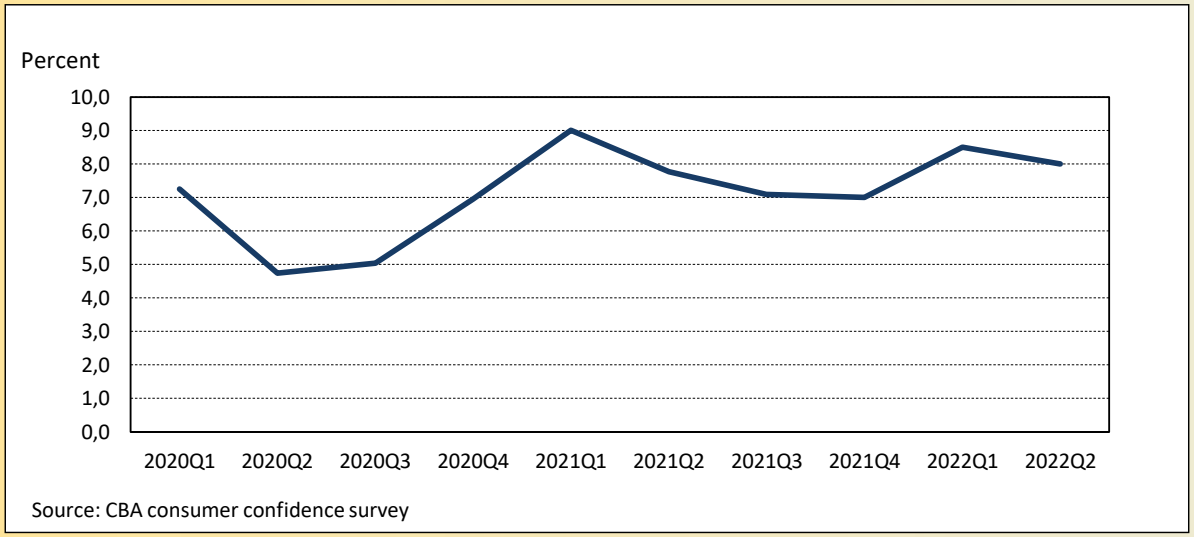


Figure 8: Proportion of surveyed Aruban residents holding bitcoin.

Financial stability – A retail CBDC benefits cashless societies

The previous section proposed that in cashless societies, people would lose access to money directly backed by the central bank, perhaps worsening bank runs and financial instability. Since the central bank would back a retail CBDC, it may dilute this risk. For example, in Sweden, the Riksbank is considering a retail CBDC because of disappearing cash usage, as proxied by the ratio of currency in circulation to narrow money (Figure 9). In 2022Q2, the Swedish ratio reached 1.5 percent. By contrast, cash "is still king" in Aruba. The Aruban percentage is about six times higher than Sweden's, or 10.0 percent. Note that the figure for Aruba excludes the amount of dollars in circulation, so the share should be considered a (conservative) lower bound estimate. In line with the previous finding, 45.5 percent of respondents in Aruba used the ATM frequently in 2022Q2, defined as daily or weekly usage. Adding those that use the ATM every month to the "frequent" group brings the total proportion to 65.7 percent. **Thus, it is unlikely that people would lose access to money directly backed by the central bank, as cash usage is popular in Aruba.**

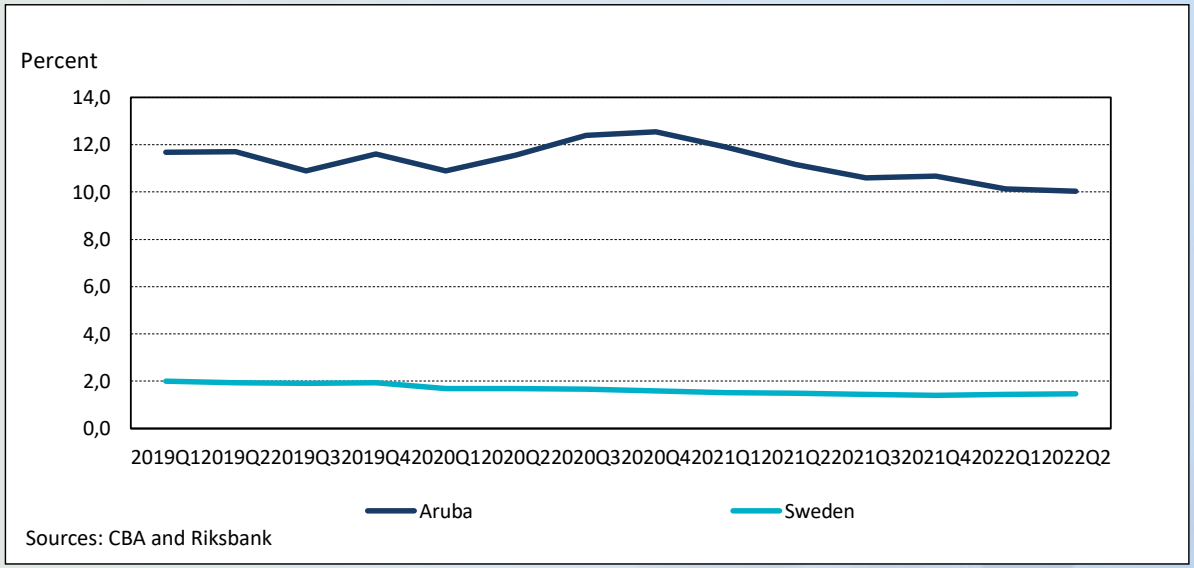


Figure 9: Ratio of currency in circulation to narrow money.

Financial stability – Payment resilience

Section 5.1 suggested that a retail CBDC can add payment resilience to the financial system. For example, the Bahamian sand dollar – a retail and wholesale CBDC – enables users to make payments at a pre-set dollar value even if the sand dollar network communication fails (CBOB, 2022a). When a retail payment system goes down in the Caribbean context, it is usually related to local power outages or problems with a single service provider. Bahamian surveyed firms reported, on average, 2.2 electrical outages in a typical month (World Bank, 2010). Year-to-date, on November 10, 2022, there were five blackouts in Aruba, which results in a monthly rate of 0.5. For a rough indication in nominal GDP terms, businesses would lose Afl. 26.8 million (0.5 percent of 2019 GDP) from less private consumption if 1) 5 blackouts occurred in 2019, 2) and 45.5 percent of transactions occur (consistent with percentage of people that frequently use the ATM). **In short, there is a case for payment resilience in Aruba, although the point is less convincing compared to The Bahamas.**

Financial inclusion – Transition from the unbanked to the banked

One of the main arguments for introducing a retail CBDC is to help the unbanked transition to the formal sector (Section 5.1). For example, the Eastern Caribbean Central Bank, the Central Bank of Jamaica, and the Central Bank of Mexico primarily cite financial inclusion as the core motivation for a retail CBDC (Hayashi and Toh, 2022). Typically, citizens of those countries lack access to financial services. In Jamaica, 72.7 percent of people over age 15 had an account in 2021 (World Bank, 2021). In Mexico, this figure dropped to 35.4 percent in 2017, although there are no data for 2021. However, Canada and Australia exhibit 99.6 percent and 99.3 percent financial account access rates, respectively (World Bank, 2021). Hayashi and Toh (2022) observe that The Bank of Canada and the Reserve Bank of Australia abstain from using financial inclusion as an argument for a retail CBDC in their country. Given the penetration rates of financial access nearing 100 percent, it is not surprising that financial access arguments are weak in those advanced economies. In Aruba, the proportion of respondents who own a current account amounts to 91.3 percent (CBA, 2021). This level is not too far from advanced economies. **Thus, the Aruban case for (improving) financial access at first seems moderate.**

One can estimate the gains under the presumption that financial access is complimentary to financial depth (as shown, for example, in Haini, 2021). Utilizing the mean elasticity of 0.014 from Bijlsma et al.'s (2018) meta-analysis of 68 studies[6], if Aruban private sector credit to GDP would have converged to Canadian levels in 2019, everything else equal, nominal 2019 GDP growth would be 0.6 percentage point higher. In 2019, Aruban GDP rose by 5.2 percent; a 5.8 percent gain would have implied an Afl. 35.0 million increase.

To reach a financial access level of advanced economies, the retail CBDC would need attractive features. Such features are permissioned DLT, some extent of privacy, offline abilities, and one-to-one conversion between commercial bank deposits and CBDC (Kiff et al., 2020).

[6] This shows that a 10 percentage point increase in the ratio of private credit to GDP leads to a 0.014 percentage point increase in annual GDP growth.

Financial inclusion – Cheaper and faster payments

The preceding section alluded that a retail CBDC can offer cheaper and faster domestic electronic payments through increased competition. In countries where instant payments are absent, this argument may hold. As only 60 countries have instant payment platforms (FIS, 2022), this argument applies to roughly 69 percent of the world. Yet, in Aruba, the I-Pago instant payments platform offers real-time payments 24 hours a day, seven days a week, 365 days a year. Further, domestic payments are cheap despite low competition across commercial banks – reflected by healthy commercial bank profits and sizable interest rate margins (IMF 2019a). Three of the four Aruban commercial banks offer I-Pago transfers free, while one bank charges Afl. 1 for every I-Pago transfer. **Hence, one can doubt whether an Aruban retail CBDC would significantly propel cheaper and faster domestic payments.**

Regarding international payments, again, the literature in Section 5.1 listed cheaper and faster payments as pros of a retail CBDC. A handful of central banks in emerging markets have enabled or envisioned a CBDC for cross-border payments, particularly with neighboring nations (Hayashi and Toh, 2022). For instance, the Central Bank of Nigeria and the Eastern Caribbean Central Bank see retail CBDCs as a way to achieve cheaper and speedier international remittances (Central Bank of Nigeria 2021; BIS 2021b). To assess these claims, one can (imperfectly) look at the regional data of these countries. Data from 2022Q2 reveal that the average cost of sending USD 200 abroad in the Latin American and Caribbean region tallied 6.0 percent (World Bank, 2022). In Sub-Saharan Africa, this figure reached 7.8 percent. These statistics are based on an aggregation of different service providers: banks and money transfer companies.
In Aruba, only bank data are publicly available for three of the four commercial banks. Taking an (unweighted) average of the three banks, the average cost of sending USD 200 via online banking equals 9.7 percent. For CMB[7], Aruba Bank[8] and RBC[9] average costs total 4.3 percent, 13.5 percent, and 11.3 percent, respectively. The calculation considers the foreign exchange commission tax, the exchange rate margin compensation, commission fees, and the corresponding bank fee (except for RBC). Unfortunately, one cannot compare Aruba with the relevant regions mentioned, as the data for monetary transfer companies are not readily available. Still, on a global level, banks are the most expensive service providers, with an average cost of 10.9 percent (World Bank, 2022). **Consequently, international payments from Aruba are slightly cheaper than the global average, although, as with other countries, Aruba has space for improvement in international payments.**

A retail CBDC with cross-border capabilities can fix the bottlenecks of traditional cross-border payments. These issues include, among others, long transaction chains, fragmented data formats, and disjointed compliance checks (BIS, 2021b). **Nevertheless, if there are reasons for non-residents to hold significant amounts of digital florin[10], it may lead in the**

[7] https://www.cmbnv.com/customer-service/fees-charges-commissions#:~:text=CMBDirect%20Corporate%3A,an%20AWG%2010.00%20monthly%20fee
[8] https://www.arubabank.com/en/About-Us/About-Us/Aruba-Bank-Fees
[9] http://www.rbcroyalbank.com/caribbean/ar/documents/AR-fee-and-service.pdf
[10] For example, when there is dollar scarcity and non-residents face an unstable home currency, or for forex broker purposes.

future to considerable foreign exchange outflows. Adequate foreign exchange reserves are critical to the fixed exchange rate between the Aruban florin and the U.S. dollar. Accordingly, the State Ordinance on foreign exchange transactions (A.B. 1990 No. G.T. 6) prohibits Aruban florins from leaving the country.

Financial inclusion – Dynamic consumer needs

Section 5.1 suggested that competition can quicken the responsiveness of businesses to dynamic consumer needs. That section also hinted that the potential gain hinges on the amount of competition already in the payment system. Four commercial banks and two payment (facilitating) service providers dominate the Aruban payments landscape. While no quantitative data are available, based on talks with stakeholders during GDP forecast consultation rounds, the perception is that the payments market share of the commercial banks is considerably larger. In the Netherlands, 39 banks are offering retail payment services, while 69 non-banks are allowed to carry out the business of payment service providers (DNB, 2022a; DNB, 2022b). It seems that, at least in the ratio of banks to non-bank payment providers, the Dutch payment system is more contested. **Accordingly, there is room for competition in the Aruban payments landscape, which can coincide with better or more payment offerings.** Instead of running the retail payment system themselves, central banks can better foster competition if they task the private sector to do it. This choice would be consistent with either an indirect or a hybrid CBDC (Section 4). Nevertheless, Aruba's innovation capacity is constrained by government effectiveness, regulatory quality, and control of corruption, among others (CBA 2022, Chapter 7). **Therefore, those deficiencies mentioned hamper businesses' ability to respond rapidly to changing consumer needs.**

Financial integrity – Reduce ill effects of cash usage

As described in Section 5.1, the CBOB argues that reduced cash usage, along with increased KYC monitoring, would enhance national defenses against money laundering, terrorist funding, and other illicit activities. While it is difficult to prove that shrunk cash usage leads to less money laundering and the related, **Figure 9 supports the notion that less cash usage is associated with fewer informal activities.** Using data from DEACI (2021) and the CBA, there is a correlation of 0.65 between cash in circulation outside commercial banks and the shadow economy in 1991-2020. Given DEACI's (2021) calculation of the shadow economy in 2019, a rough estimate of the lost turnover tax revenue is Afl. 45.3 million[11] (or 1.3 percent of nominal GDP). Money that the government could have directed to public consumption or public investment. **Nonetheless, a retail CBDC can decrease the hazardous effects of cash only if adoption is widespread.** Thus, CBDC needs attractive features, such as offline capabilities, permissioned DLT, some degree of privacy, and a one-to-one conversion between commercial bank deposits and CBDC (Kiff et al., 2020). Central banks can balance privacy and KYC requirements by instilling tiered accounts.

6.1 Risks

Financial stability and monetary stability – Commercial bank disintermediation

[11] Using the turnover tax-to-GDP ratio of 3.6 percent in 2019 and given the estimated size of the shadow economy at 21.1 percent of GDP.

As motivated in Section 5.2, a retail CBDC can drain commercial banks' funding, especially those that depend heavily on retail deposits. September-end 2022, retail resident deposits form 84.8 percent of total funding, confirming that Aruban commercial banks rely on retail funding. **Accordingly, a retail CBDC may drain crucial funding sources of commercial banks, affecting their livelihood. At the same time, central banks can mitigate this risk.** Users cannot conduct high-value transactions by putting a cap on CBDC holdings, mitigating sizeable potential outflows from commercial bank deposits to CBDC holdings (Figure 5). Moreover, by skipping remuneration on CBDC deposits, commercial bank deposits remain relatively appealing. Even if some retail bank deposits move to a CBDC, the higher cost of funding does not necessarily hurt profitability (and financial stability). Namely, IMF (2019a) reports that Aruban commercial banks enjoy healthy profits and sizable interest rate margins, partly reflecting weak competition. Furthermore, given the ample amount of excess liquidity in Aruba (CBA, 2023), if some retail deposits are converted to CBDC, the impact on cost of funding may be minute.

Financial stability – Worsened bank runs

A retail CBDC can worsen bank runs, as converting commercial bank money into CBDC is more straightforward than cash (Section 5.2). However, this risk is contingent on trust in the financial system (a country-specific characteristic) and on the design of the CBDC. Relevant to the former, the deposits of individuals (excluding enterprises and the government sector) are 6.9 times larger than the currency outside banks September-end 2022 in Aruba. **This observation may indicate that households trust non-central bank money. People might then perceive that the risk of losing their deposits is low, providing no spark for a bank run.**

Furthermore, the CBA performs the role of lender of resort. This mechanism bolsters confidence in commercial bank deposits; rendering bank runs less likely. Nevertheless, people may be unaware of such an arrangement, and the parliament has still not passed the law regarding a deposit insurance scheme. One control proposed is limiting the amount of CBDC that any individual can possess. In the case of an interest-bearing CBDC, one alternative restriction would be a remuneration rate of zero for holdings over a particular level. Yet, it is unclear whether this action would sufficiently deter a bank run during a severe financial crisis (Richards et al., 2020).

Financial stability – Cybersecurity risks

The previous section emphasized that a retail CBDC is susceptible to cybersecurity threats and operational disruptions. A retail CBDC would produce another access point for a cyberattack. **Moreover, while no data are publicly available on the number of cyberattacks on the Aruban financial system, given the number of cyberattacks seen elsewhere, there is reason to believe that Aruba is no exception.** In 2019, the reported fraction of European banks targeted by one or more cyberattacks was 40 percent, up from 28 percent in 2018 to 40 percent in 2019. (DNB, 2022c). Closer to home, the South American region reported five cyber incidents targeting financial institutions in 2020 and 2021 (Carnegie, 2022). To somewhat attenuate cybersecurity risks, strict privacy policies may create and store less sensitive data. As a result, potential attackers have fewer incentives to breach the system of central banks and PSPs (depending on where customer data is stored, in the case of a hybrid retail CBDC, both). Moreover, having less sensitive

data by itself may possibly lessen the severity of a successful attack.

Section 7. Policy recommendations for a retail digital florin

The policy recommendations are partitioned across three dimensions: design, enabling conditions, and implementation. In what will be shown, the design recommendations are relevant for the first step of the implementation process, while the enabling conditions are prerequisites for advancing across the five stages of implementation.

7.1 Design recommendations

With the knowledge of Section 4, Section 6 provided the risks and benefits of specific retail CBDC design options specifically for Aruba. **For policymakers to proceed with a retail digital florin, minimum design criteria must exist. The minimum design criteria are such that the proposed design maximizes the benefits and minimizes the risks.** Since this policy paper sees the risks and benefits through the lens of monetary stability, financial stability, financial inclusion, and financial integrity, so do the minimum design criteria.

This policy paper recommends offline features for payment resilience when there are power outages or network disruptions. This action is one of the prerequisites for maximizing the benefits of a digital florin. In this setting, economic activities can continue, contributing to financial stability. If offline features are not economically viable, another avenue to elevate resilience is providing CBDC payment services to retail users via different platforms and technologies to those currently used by banks and other PSPs.

Another benefit is that a retail digital florin can bring the unbanked into the formal sector, which is relevant for financial inclusion. Typical impediments in the region are not having a proof of income and/or a local ID (Pletersz and Fransisco, 2023). **The unbanked can access the digital florin by downloading a digital wallet on their smartphone, and top up their wallet balance with a cash deposit at the non-bank PSP.** Financial inclusion can push economic activity upwards by enabling people to start and expand their businesses more easily, manage risk, and absorb shocks (CBA, 2019c). **For financial inclusion to materialize, this policy paper recommends four attractive digital florin features from the consumers' perspective.** Such features are permissioned DLT (for smart contracts), some extent of privacy (to mimic the utility of cash and lower the entry to barrier into the digital banking system), offline abilities (to have an advantage over commercial bank money), and one-to-one conversion between commercial banks deposits and the digital florin (to be at least as attractive as commercial bank money). **From the perspective of businesses, convenience (speed and access), control (ease of use), and competence (prior digital banking experience) would likely motivate the adoption of a retail digital florin.** On the other hand, costs (price and fees) would dissuade engagement with the digital florin. These assumptions follow the mentioned drivers of commercial instant payment adoption (CBA, 2018).

This policy paper suggests a three-tiered model, so residents reduce cash usage and policymakers bolster financial integrity, akin to the Central Bank of Nigeria (CBN). Such models balance KYC monitoring and privacy. To ensure

that balance, non-bank customers may conduct low-value transactions, granted they provide a verified local phone number (CBN, 2021a). Non-banked customers can transact at medium values (in the Nigerian example, to the tune of USD 113.9 at the moment of writing) provided they have a verified phone number and a National Identification Number (NIN). Besides those two requirements, banked customers require a Bank Verification Number (BVN) to conduct high-value transactions. The BVN also prevents offenders from hacking into the system, a feature relevant to financial stability.

Another benefit of a retail CBDC is potentially fostering competition, thereby quickening the responsiveness of businesses to dynamic consumer needs. These efforts relate to financial inclusion. **This policy paper advises central banks to decentralize the customer-facing duties (retail payments clearing, KYC checks) to foster competition in the payments system.** Such a design would be consistent with either an indirect or a hybrid CBDC, allowing for a permissioned DLT-based CBDC (Section 4).

In terms of minimizing the risks, this policy paper urges a cap on digital florin holdings and a non-interest-bearing CBDC. These measures prevent large outflows from commercial bank deposits to digital florins, also easing concerns of (unlikely) runs on Aruban banks. In the end, these measures benefit monetary and financial stability. **Further, this policy paper advises, for the time being[12], against cross-border abilities, given significant monetary stability concerns.** Although it is difficult to stop non-residents from holding digital florins, the three-tiered KYC approach mentioned above can mitigate outflows.

Fanti et al. (2022) mention six principles to inhibit cybersecurity risks and encourage financial stability. They are relevant to the CBA, the government, and PSPs.

- **Principle 1: Where possible, use existing risk management frameworks and regulations.** Cybersecurity policy for a retail digital florin does not have to reinvent the wheel. There are rules, regulations, and standards already in place that if applied, can aid in the prevention of cyber-attacks on the banking industry. Some apply directly or may serve as a valuable starting point for future adoption.
- **Principle 2: Privacy can strengthen security.** Retail digital florin designs that give weight to the principle of privacy may also be more secure. The line of thinking is that privacy-preserving digital florins limit the potential harm caused by cyberattacks, such as data exfiltration. After all, stricter privacy policies may create and store less sensitive data. As a result, potential attackers have fewer incentives to breach the system of central banks and PSPs (depending on where customer data is stored, in the case of a hybrid retail CBDC, both). The consequences will probably be less severe even if an attack is successful.
- **Principle 3: Test, test, and test some more.** The CBA and PSPs need to regularly test the layers of the CBDC stack (Figure 7, first column). For example, at the hardware and application layers, technical inspectors should test wallet software and hardware for vulnerabilities that could enable attackers to steal funds from users, exfiltrate data, or prevent the execution of transactions. Another crucial CBDC layer stack is consensus, as smart contracts powered by DLT will

[12] As a more recent IMF technote by He et al. (2023) explain how CBDCs could be designed to facilitate cross-border payments while still managing capital flows.

be instrumental to future digital florin applications. Therefore, engineers must regularly conduct in-person reviews at the consensus layer, read and approve the smart contract code, and grant approval. Bugs in smart contracts, which might let perpetrators distribute funds improperly, have already resulted in significant losses in cryptocurrencies (Aquilina et al., 2021).

- **Principle 4: Ensure accountability.** Testing alone is insufficient. Most pieces of major software have bugs, and digital florins will be no exception. Given this observation, central banks and PSPs must set explicit rules and regulations governing accountability and consequences for such errors. For example, who is liable when a digital florin undergoes a smart contract that allows citizens to withdraw more money than was originally intended? The developer of the smart contract or the company that recruited the developer?
- **Principle 5: Promote interoperability.** The digital florin should be interoperable with the existing domestic financial infrastructure. Furthermore, PSPs and banks should supply digital florin payment services on different platforms and technologies than currently exist. This recommendation strengthens countries' financial systems' resilience to cyberattacks.
- **Principle 6: When new legislation is required, make it technology neutral.** Technology neutrality means that laws apply equally across diverse technologies over time rather than a specific technology that may exist today (Selvadurai, 2018). For a retail digital florin, this principle implies that the government should initially consider setting security requirements at some level of abstraction and let experts propose periodic updates. Alternatively, rather than establishing a specific numerical threshold for an acceptable number of cyber incidents per year, the government should employ incentives or call for accountability (Principle 4).

Thus, design options exist that maximize the benefits and minimize the risks of a retail digital florin. These options make a retail digital florin achievable from the point of view of monetary stability, financial stability, financial inclusion, and financial integrity. However, in deciding whether or not proceed with a digital florin, other considerations also matter (see Section 8).

7.2 Enabling conditions

For the local private sector to participate in the digital florin ecosystem and keep up with the implementation scheme (Figure 10), innovation capacity in Aruba must improve (Chapter 7 of CBA, 2022). Accordingly, if not present, the private sector must have the managerial capabilities to identify new technological opportunities, develop a plan, and cultivate the human resources to exploit them (Cicera & Maloney, 2017).

As for the government sector, it ought to provide innovation complementarities, a set of institutions, laws, incentives and customs needed for innovation (Mohnen & Röller, 2005). The government can foment innovation complementarities by lowering business costs, broadening financial markets, and mitigating macroeconomic volatility. For specifics on how to reach those states, refer to Chapter 3 and 6 of CBA (2022).

An institution that can glue and coordinate the different innovation complementarities together is a National Council of Economic Advisors (CBA, 2022). Such an institution ensures data and evidence-based economic policy development, closing the gap between scientific research and political decision-

making and fortifying economic institutional capabilities. Drawing inspiration from CBA (2019c), subcommittees such as for financial inclusion and digital payments can exist. These subcommittees can oversee the development, implementation, and management of specific financial inclusion programs. As a national, multi-stakeholder platform, it would consist of government representatives (e.g., ministries of innovation, finance, education, and economy), and financial institutions (e.g., CBA, Aruba Bankers Association, and Insurance Association Aruba).

Besides innovation complementarities, the government sector should provide remedies for the market failures specific to R&D. Possible actions include R&D subsidies, tax incentives, and the creation of non-market institutions such as public universities.

Furthermore, innovation initiatives (such as retail digital florin use cases) require collaboration between universities, governments, and firms. Concretely, the government's task is to cultivate "good institutions" (political stability, property rights protection, and control of corruption, among others), oversee the interactive process, and intervene when necessary. In particular, a multi-year framework can guide the interactive process. Given the processual and possibly disruptive nature of a retail digital florin and its connection to SDG planning, this policy paper proposes a multi-year framework. As shown in the following subsection (Figure 10), the framework incorporates short to medium-term milestones. These milestones help the digital florin advance through the stages of a possible implementation.

7.3 Implementation recommendations

If there is a robust proof-of-concept for a retail digital florin, then policy makers should follow existing best practices for implementation. The proposed implementation process has five steps (CBA, 2019b). **This chapter meets partly the first step of the implementation process,** as it proposes the minimum design criteria of a possible digital florin, and hence, an input for assessing the feasibility of a digital florin. The rest of the feasibility stage concerns operations costs, set-up costs, and alternatives, among others. Section 8 loosely indicates the costs, in addition to general points of attention when discussing alternatives. Therefore, more research needs to be done in this area.

The second step involves determining the terms and conditions for the regulatory sandbox. A regulatory sandbox is a controlled regulatory environment where firms can live-test new, innovative products, services, delivery channels, or business models. In this step, the CBA should review previous CBDC regulatory sandboxes, deduce the lessons learned, and tweak them to conform to the local Aruban context. The Framework for Regulatory Sandbox Operations (CBN, 2021b) is a valuable starting point. Concurrently, the public sector should pass a law making the digital florin a legal tender. This action allows firms to begin experimenting with use cases within the sandbox.

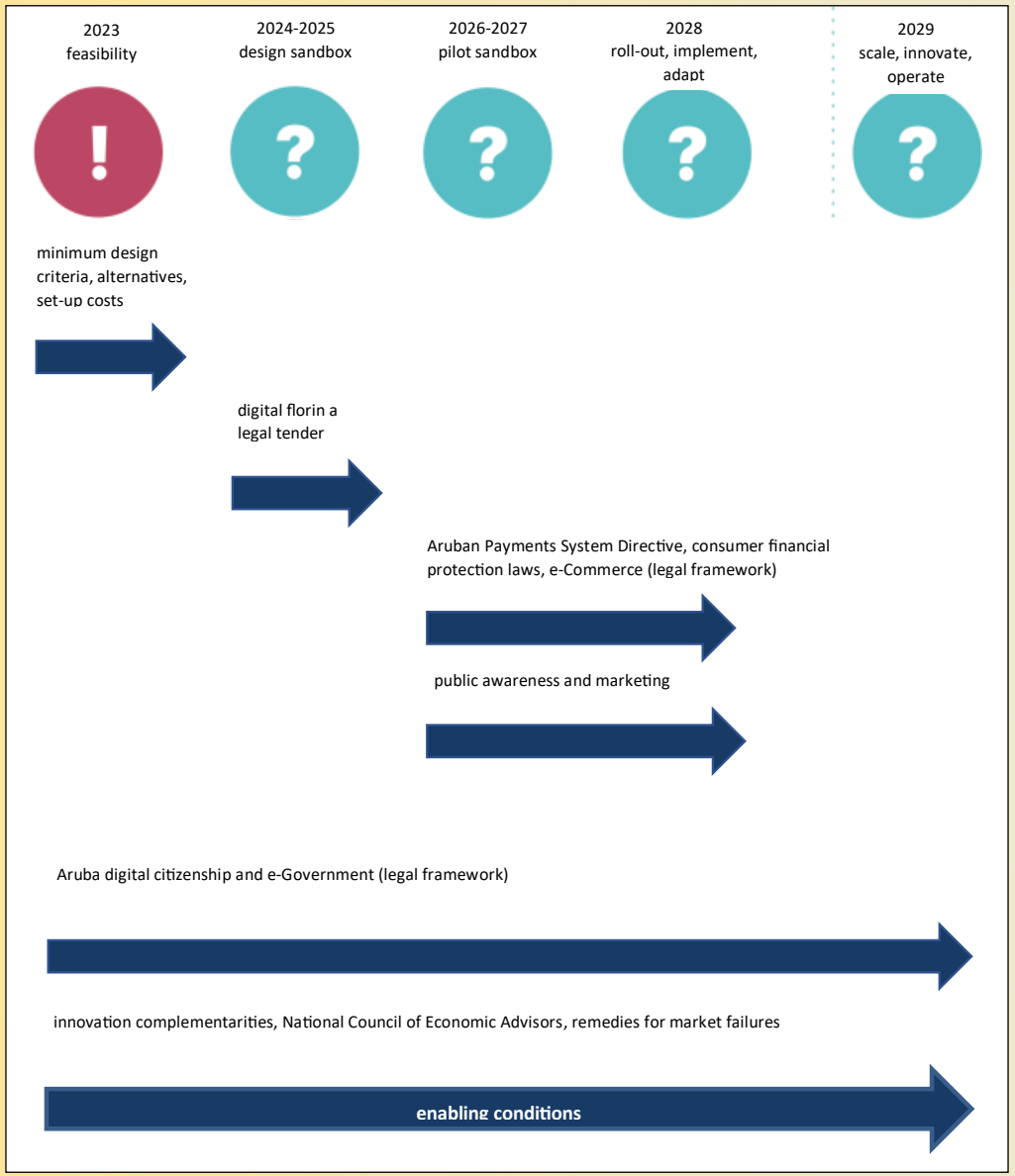


Figure 10: Five stages of the digital florin implementation roadmap. Adapted from CBA (2019b).

In the third step, the CBA announces the regulatory sandbox, and interested parties can start their innovation processes within the parameters of this sandbox. In the meantime, the CBA and the government can evaluate progress and subsequently draft legislative amendments for the full-scale introduction. In particular, an Aruban Payments System Directive (APSD) would regulate payment services and payment service providers. In the spirit of the Revised European Payments Service Directive, it would increase competition and participation (of non-banks) in the payments industry (European Commission, 2007). Additionally, an APSD can benefit consumer protection by formalizing the rights and obligations of (digital) payment providers and users. Apart from drafting legislative changes, the CBA can develop a marketing strategy to increase the likelihood of user adoption. In this regard, the CBOB (2022b) stressed the importance of educating users, inspiring user confidence, and encouraging a network of merchants that accept CBDC.

In the fourth step, once the government finalizes the legislative changes, the CBA can invite the partners which advanced far enough in the sandbox to roll out their product. In between, the CBA can run public awareness campaigns about the digital florin. Support needs to be broad-based, requiring customer-engagement from commercial banks and credit unions.

In the final step, the CBA should stimulate new use cases within the existing regulatory sandbox and repeat the process. Crucial to scaling the retail digital florin is the finalization of the Aruba Digital Citizenship – facilitating digital signature and identification – and the e-Government (legal) platform. A relevant use case for example, is the collection and disbursement of payments on GoA's future e-Government platform.

Section 8. Discussion

Note that this policy paper only considered monetary stability, financial stability, financial inclusion, and financial integrity as the minimum design criteria. According to the rough calculations in Section 6, the proposed digital florin incurs potential GDP gains of Afl. 107.1 million (in nominal 2019 terms). However, other considerations also matter. For example, the Reserve Bank of India is also interested in reducing the cost of storing, printing, and transporting cash using CBDCs (RBI, 2021). Alvez and others (2020) estimated that the private costs of using cash in Uruguay were about 0.61 percent of the GDP. The main costs related to cash usage are the cost of producing notes and coins, the cost of transportation and security incurred by the banks and retailers, the costs incurred by consumers in terms of fees paid, and other implicit costs such as time cost for cash withdrawals and time cost at the cash register. A review of the relevant literature found that such private costs ranged from 0.15 percent of GDP (Norway) to 0.58 percent of GDP (Belgium). If Aruba lies between these two extremes, a range estimate of the cost (in 2019 nominal GDP terms) is between Afl. 9.6 million and 35.0 million. Kosse et al. (2017) reported similar numbers for the cost of cash in Canada (0.5 percent of GDP). However, considering that managing digital cash may be more complex and technologically advanced than managing physical cash, digitalization of currency will unlikely lead to cost reduction (Kiff et al., 2020).

This policy paper also did not explicitly address the costs of setting up and operating a digital florin. In this respect, Kiff et al. (2020) present a breakdown of the type of costs.

Cost Category	Examples
Labor	IT consulting firm; developers; user experience specialist; wallet maintenance costs, etc.
Infrastructure	Cloud or on-premise servers
Software	Licenses; service fees
Cyber Security	Threat modeling; protection; identification; response management; penetration tests. Etc.
Support	Help desk; training; communication

Table 7: Breakdown of the costs involved in setting and running a digital florin. Source: Kiff et al. (2020).

According to the CBOB 2021 Annual Report, the sand dollar project cost USD 7,499,753 as of December 31, 2021. Compared to a year earlier, the cost was USD 6,173,721. Sand dollar holdings stood at USD 303,785 end-2021, up from USD 192,625 by end-2020. Therefore, costs increased by USD 1,326,032, while CBDC in circulation rose by USD 111,160, which may provide an indication of the (marginal) costs of a CBDC.

Stakeholders must research whether financial inclusion (and other goals) is achievable with fewer resources or by alternative means. Viable alternatives are wholesale CBDCs, more use cases of CBA's instant payment platform I-Pago and various harmonization efforts to improve cross-border payments. Meanwhile, potential stakeholders need to prepare for the possibility of a digital florin because it will affect the whole Aruban society and will take several years to develop. This policy paper is the first public one to promote discussion and knowledge within the Aruban context.

Section 9. Conclusion

There are multiple theoretical benefits of a retail CBDC (Table 2). These include bringing a competitor for crypto (Kosse and Matteit, 2022; BIS, 2021), helping cashless economies (Riksbank, 2022), payment resilience (BoC; 2022), transitioning the unbanked to the banked (Barontini and Holden, 2019). Other theoretical benefits are promoting competition in payments (FED, 2022), cheaper and faster payments (Mancini-Griffoli et al., 2018)) and adaptability to dynamic consumer needs (BIS 2022a). The theoretical benefits can affect financial stability, monetary stability, financial inclusion, and financial integrity. These four dimensions, in the end, shape inclusive resilience.

However, not all the benefits hold in the Aruban economic context. One valid advantage in the local context is the reduced ill effects of cash usage. A country can reach this state by introducing a three-tiered model to balance KYC monitoring and privacy. Another justifiable benefit is fostering the transition from the unbanked to the banked and payment resilience. Granted, the retail CBDC must have the attractive features of permissioned DLT (for smart contracts) and some extent of privacy (to mimic the utility of cash and lower the entry barrier

into the digital banking system). Furthermore, other attractive characteristics comprise offline abilities (to have an advantage over commercial bank money) and one-to-one conversion between commercial bank deposits and CBDC (to be at least as attractive as commercial bank money). These design options yield a potential GDP gain of Afl. 107.1 million.

As for the remainder of the potential benefits, a retail CBDC with cross-border capabilities can provide cheaper and faster payments. However, this design is unadvisable as significant digital florin outflows may, in the future, lead to considerable foreign exchange outflows. Moreover, there is room for competition in the Aruban payments landscape, which can coincide with better or more payment offerings. This policy paper also advises central banks to decentralize the customer-facing duties (retail payments clearing, KYC checks) to foster competition in the payments system. Nevertheless, Aruba's innovation capacity is constrained. Aruba can expand its innovation capacity if the government provides innovation complementarities and addresses market failures specific to R&D (see Section 7 for specific examples). Furthermore, if not present, the private sector needs to have the managerial capabilities to identify new technological opportunities, develop a plan, and cultivate the human resources to exploit them (Cicera & Maloney, 2017).

There are also multiple theoretical risks of a retail CBDC (Table 3). These risks comprise commercial bank disintermediation (BIS, 2018), worsened bank runs (BIS, 2018), and cybersecurity (FED, 2022). Not all the risks hold in the Aruban economic context. Bank runs are presumably unlikely in Aruba as deposits are significantly larger than cash holdings outside banks, indicating that Aruban households probably trust non-central bank money. Nonetheless, bank-specific and market risks can still spur bank runs. Some risks hold in the local context, but central banks can partially mitigate them with an appropriate CBDC design. First, putting a cap on a CBDC holdings and making them non-interest bearing can reduce the likelihood of commercial bank disintermediation. Second, cybersecurity is always a valid concern, and central banks and PSPs can do their most by following six principles indicated in Section 7.

In short, this study recommends the following minimum design criteria for a retail digital florin: a three-tiered KYC approach (to balance privacy and KYC efforts), offline features, one-to-one conversion between commercial bank deposits and CBDC, non-interest bearing, permissioned DLT, decentralized customer-facing activities, and no cross-border payments.

If there is a proven case for a retail digital florin, then policy makers should follow some best practices for implementation. The best-practice implementation process has five steps. This policy paper meets partly the first step of the implementation process, as it proposed a digital florin with the minimum design criteria, an input for assessing the feasibility of a retail CBDC. The second step involves determining the terms and conditions for the regulatory sandbox. In the third step, the CBA announces the regulatory sandbox, and interested parties can start their innovation processes within the parameters of this sandbox. In the fourth step, once the government finalizes the legislative changes, the CBA can invite the sandbox partners to roll out their product. In the final stage, the CBA should stimulate new use cases within the existing regulatory sandbox and repeat the process.

	CBA	GoA	Private sector
Design recommendations	Require offline features, or let the private sector provide CBDC payment services to retail users via platforms and technologies other than those currently used by banks and other PSPs.		Implement offline features, or provide CBDC payment services to retail users via different platforms and technologies to those currently used by banks and other PSPs.
	Enforce permissioned DLT, allow some extent of privacy, and stipulate one-to-one conversion between commercial banks deposits and CBDC.		Carry out permissioned DLT, offer some extent of privacy, and guarantee one-to-one conversion between commercial banks deposits and CBDC.
	Stipulate a three-tiered model.		Realize a three-tiered model.
	Place the customer-facing duties (retail payments clearing, KYC checks) on the private sector.	Arrange innovation complementarities.	Execute the customer-facing duties.
	Caps on holdings, non-interest bearing, no-cross border payments		
	Relevant for cybersecurity: use existing risk management frameworks and regulations, give weight to privacy, regularly test the layers of the CBDC stack, ensure accountability, promote interoperability with the existing domestic financial infrastructure.	Relevant for cybersecurity: When new legislation is appropriate, make it technology neutral.	Relevant for cybersecurity: use existing risk management frameworks and regulations, provide some degree of privacy, regularly test the layers of the CBDC stack, ensure accountability, guarantee interoperability with the existing domestic financial infrastructure.

Enabling conditions (conform to Figure 10)		Steps 1-5: Innovation complementarities, address market failures specific to R&D.	
Implementation recommendations (conform to Figure 10)	Step 1: Execute a feasibility study. Step 2b: Determine the terms and conditions for the regulatory sandbox. Step 3a: Announce the regulatory sandbox. Also develop a marketing plan. Step 4b: Invite the sandbox partners to roll out their product. Raise awareness about digital florin. Step 5: Stimulate new use cases within the existing regulatory sandbox.	Step 2a: Make the digital florin a legal tender. Step 3b: Develop an Aruban Payments System Directive, consumer financial protection laws, and an e-Commerce legal framework. Step 4a: Finalize legislative changes Steps 1-5: Establish Aruba digital citizenship and e-Government (legal framework).	Step 3c: Innovate within the bounds of the regulatory sandbox. Step 4c: Roll out nationwide product. Additionally, run marketing campaigns. Step 5: Scale existing use cases and find new use cases.

Table 6: Summary of the policy recommendations for different stakeholders.

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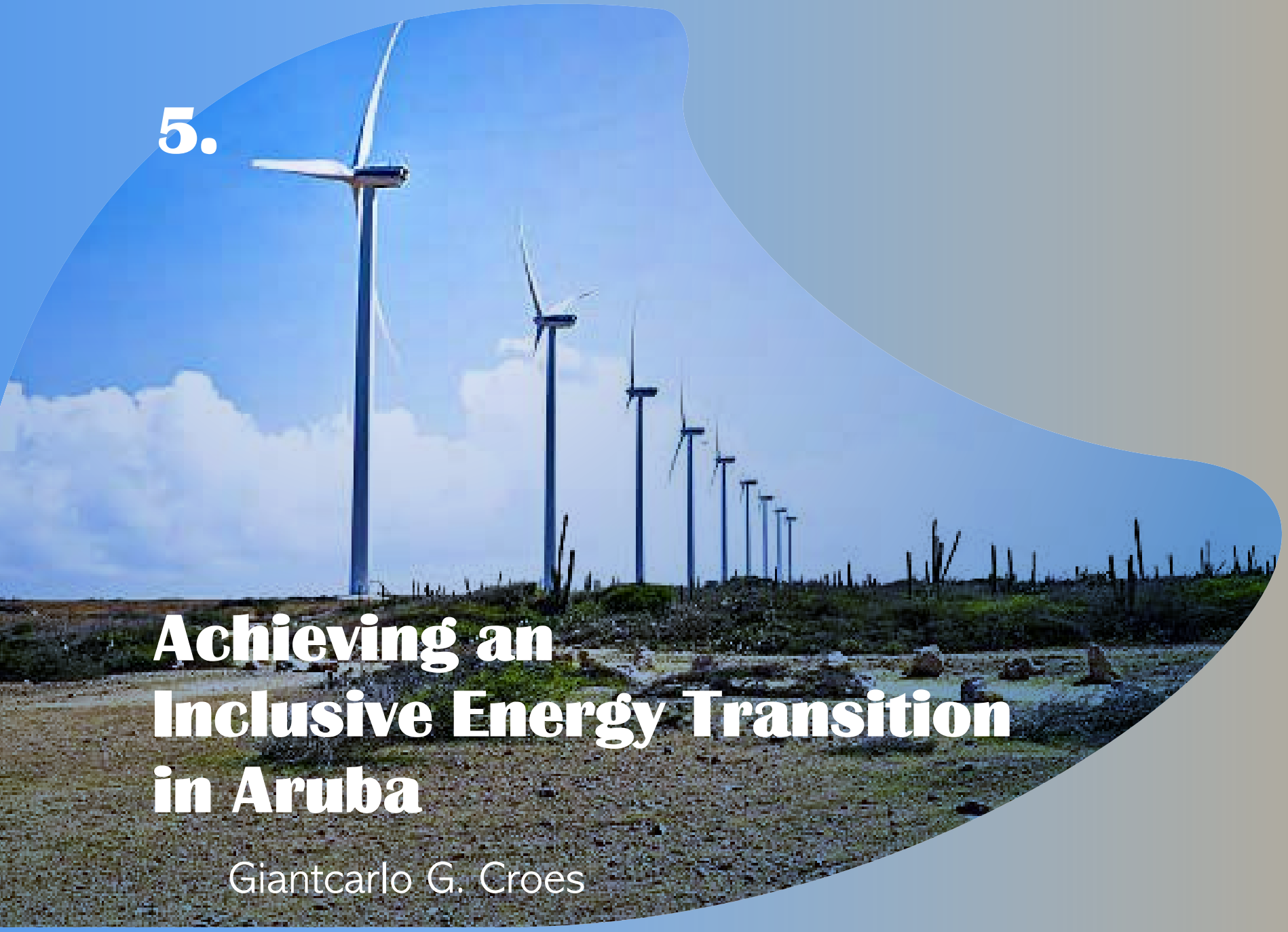
Glossary

- Account-based CBDC: account-based CBDCs pivot on one party's capacity to confirm the would-be payer's identity
- Application programming interface (API): API is a set of rules and specifications followed by software programs to communicate with each other. It is an interface between different software programs that facilitates their interaction.
- Block: A batch of pending transactions waiting to be confirmed by miners.
- Blockchain: A non-manipulable ledger of all transactions. As transactions are verified, a chain is created and added to previously executed transactions to create a new block. Certain types of cryptocurrencies use this way of recording transactions.
- Censorship attacks: In smart contracts, attackers post a false assertion, then try to censor any challenge on the transactions until the deadline passes and the false claim is confirmed.
- Cryptocurrency (or crypto for short): A currency issued by the private sector that relies on technologies such as distributed ledger technology.
- Central bank digital currency (CBDC): A CBDC is a digital currency issued by a central bank.
- Digital currency: An electronically created and - stored currency.
- Digital florin: A digital currency issued by the CBA.
- Disintermediation risks: Defined as the risks that central bank money (e.g., CBDC) replaces commercial bank deposits.
- Distributed ledger technology (DLT): DLT saves information through a distributed ledger, a repeated digital copy of data available at multiple locations.

- DeFi: A set of activities across financial services built on DLT, such as blockchains.
- FinTech: A collective name for innovative financial technology companies. This type of company provides or enables (new) financial services.
- Partitioning attacks: Attacks in DLT systems that force various portions of the network to have separate views of the ledgers.
- Retail CBDC: A CBDC intended for the public.
- Smart contract: A smart contract is an automated contract in which the conditions of the buyer-seller agreement are encoded into lines of code.
- Stablecoins: A cryptocurrency that pegs its value to a currency or commodity.
- Tokens: A token is a unit of cryptocurrency.
- Token-based CBDC: Token-based CBDCs rely on the payee's ability to validify the payer's payment object (in this case, the CBDC token).
- Wholesale CBDC: A CBDC intended for financial institutions.

5.



Achieving an Inclusive Energy Transition in Aruba

Giantcarlo G. Croes

Abstract

The main focus of this chapter is the transition towards clean energy for Aruba and the policies that should be implemented to ensure an inclusive energy transition. For this shift to be successful, policies must allow all citizens to benefit from the opportunities and cope with the disruptions. Aspects to consider are social and economic impacts as well as issues relating to affordability and fairness. Policies recommended here are based on best practices and an inventory of information on the current state of energy in Aruba.

While Aruba has already taken steps toward advancing clean energy policies by establishing wind and solar initiatives, the share of renewables in total power production has been stagnant for a number of years. In addition, in the transportation sector the vast majority of vehicles still run on fossil fuels, with EV's representing a fraction of the car park. Consequently, Aruba still imports a significant volume of fossil fuels and is susceptible to disruptions and price volatility in international markets. It is therefore imperative that Aruba ramps up renewable energy generation, overcoming several challenges to this transition. Achieving large-scale renewable energy production will likely require a paradigm shift from centralized top-down control to distributed bottom-up control. Recommended policies include those that maximize job creation, focus on skills and training, boost social and economic development, and enhance energy security, affordability, and resilience.

5.1 Introduction

Like the rest of the world, Aruba faces the daunting challenge of realizing an energy transition in the coming years. The importance of this transition is reflected in its inclusion in the United Nations agenda for sustainable development (UN, 2015A), where it is formulated as "Achieving Sustainable Energy for All." Achieving this sustainable development goal (SDG) by 2030 is crucial for realizing several other SDGs related to health, food security, gender equality, education, economic development, and more. Access to affordable and reliable energy services is essential for economic growth and well-being. Moreover, affordable and reliable energy services are necessary to provide residents opportunities to engage in personal and economic development and even in many social activities. It follows then that energy access is essential for an inclusive society.

The energy transition is about more than providing access to energy for everyone. It is also about the sustainability of energy services, preserving the quality of the living environment, and nature's regenerative capacity. In this regard, the focus of the energy transition is on combatting climate change to keep our planet habitable. Yet another driver of the transition to renewable energy sources is energy security, i.e., the desire to reduce exposure and vulnerabilities to geopolitical risks and disruptions in the market for fossil fuels.

The World Economic Forum (WEF) defines an effective energy transition as a "timely transition towards a more inclusive, sustainable, affordable and secure energy system that provides solutions to global energy-related challenges while creating value for business and society without compromising the balance of the energy triangle."[1] Research by Fisher, Sheehan, and Colton has defined households with an energy burden of 6 percent of income or higher as experiencing a high burden.[2] Renewable energy sources have a marginal production cost of zero and are therefore the most affordable energy sources in the long-run. Meanwhile, an inclusive energy transition explicitly takes into account the distribution aspects of both the benefits and the disruptive effects on residents, promoting policies tailored according to income and spatial distributions.

Different energy sources have distinct characteristics with regard to the aforementioned criteria. Table 5.1 provides a brief overview.

[1] The energy triangle consists of economic development and growth, energy security and access, and environmental sustainability. WEF, Fostering Effective Energy Transition, 2019 edition.

[2] Fisher, Sheehan & Colton, Home Energy Affordability Act, 2013.

Type of energy	Inclusive	Sustainable	Affordable	Secure
Solar (centralized)	Yes, produced centrally so everyone has access.	Yes, clean/renewable.	Produced centrally and the marginal cost of production are low.	Yes, only dependence on materials for the panels and on the presence of sunrays.
Solar (decentralized)	No, likely only accessible to high-income households (if no additional policies).	Yes, clean/renewable.	Due to the relatively high purchase and installation costs, only affordable for high-income households.	Yes, only dependence on materials for the panels and on the presence of sunrays.
Wind	Yes, produced centrally, everyone has access.	Yes, clean renewable.	Produced centrally and the marginal cost of production are low.	Yes, only dependence on materials for the wind turbines and on the presence of wind.
Fuel oil	Yes, produced centrally, everyone has access.	No, high CO2 emission.	Depends on the price on international markets.	Limited, depends on volatile international oil markets and international production.

Table 5.1: Characteristics of energy sources with regard to inclusiveness, sustainability, affordability, and security

The energy transition must achieve several objectives. First, it must address the challenge of rising energy demand and environmental sustainability while maintaining economic growth. In addition, it has to replace fossil fuel-based technologies with more efficient and low-carbon alternatives. The recent spike in energy prices since Russia's invasion of Ukraine underscores the need for a transition away from energy sources subject to recurrent disruptions. Finally, these goals must be reached while pursuing equity and justice when distributing socioeconomic costs. In other words, the energy transition has to be inclusive, i.e., ensure the availability of sustainable, reliable, and affordable energy services for every member of society.

The WEF suggests that successful energy transitions require an understanding of the challenges involved, potential solutions, and science underpinning those solutions. A successful energy transition demands an effective energy transition strategy. This strategy will differ by country as each country is unique, but a few critical aspects include:

- Using transitional energy sources (e.g., natural gas)
- Increasing energy efficiency
- Raising renewable energy investments
- Implementing a supportive energy policy[3]

The multiple objectives demand comprehensive and coordinated policy packages. These policy packages will require maximizing synergies and mitigating trade-offs among measures to meet individual goals.

[3] The global energy transition, an ultimate guide, WEF.

This chapter addresses the current energy mix in Aruba and how it has evolved over the years. Next, information is provided on the energy transition state in the Caribbean islands and comparison is offered between selected countries and Aruba. An overview is provided of the energy transition's potential social and economic impacts on individuals and the community, while addressing potential challenges and bottlenecks. Finally, ways to achieve an inclusive energy transition in Aruba are addressed through several policy recommendations.

5.2 Energy transition in the Caribbean

As for Aruba, energy efficiency and sustainability and building resilience in energy systems are fundamental challenges for the entire Caribbean region. While solar and wind energy sources are abundantly available in the Caribbean, the share of renewable energies in the electricity grid is typically low. Consequently, expenditures for fossil fuels are significant; Caribbean nations spend a large percentage of their export revenues - in some cases nearly 50 percent - on oil imports to pay for their energy generation.[4] The dependence on costly imported petroleum products has exposed the islands in the region to high electricity prices and the detrimental economic impact of oil dependence. In addition, Caribbean countries and their energy sectors are vulnerable to the effects of climate change. Natural disasters occur more frequently and intensely and have weakened resilience in the Caribbean. The prospect of further climate change underlines the need for the energy sector to transition to clean energy technologies resilient to weather events that are also cost-effective, sustainable, and reliable. Leveraging renewable resources, such as solar and wind energy, is essential for more sustainable, reliable, and affordable developments.

Recently, Caribbean islands have attracted initiatives meant to hasten a shift to renewable forms of energy by harnessing the region's available solar, wind, and geothermal power.[5] These initiatives have been proposed by development officials, consultants, financiers, and renewable energy entrepreneurs seeking to guide and sometimes profit from the imminent energy transition. The prospect of billions of dollars of funding could make the Caribbean a potential laboratory for renewable energy strategies, policies, and projects geared toward reshaping the region's legal and regulatory environments and re-engineering its energy landscapes and infrastructures.

The islands in the Caribbean are at different stages in the energy transition, with varying degrees of renewed energy capacity installed and enabling regulation in place. The next section provides an overview of the energy transition for a group of selected Caribbean islands.[6]

Curaçao

As of 2020, Curaçao, which like Aruba is part of the Kingdom of the Netherlands, had a renewable energy (RE)

[4] Green ammonia enables sustainable energy production in small island developing states: A case study on the island of Curaçao.

[5] Geographies of renewable energy transitions in the Caribbean.

[6] The information of the Caribbean islands is based on information found in the U.S. Department of Energy's Energy Snapshot of June 2020, unless stated otherwise.

installed capacity share of 33 percent of its total installed capacity.[7] The RE installed capacity share of Curaçao is nearly twice the share of RE capacity currently installed in Aruba. Wind energy is the leading renewable energy source in Curaçao's energy mix at 29 percent of total production. Solar energy is responsible for just 4 percent of energy production. The primary source of energy production is still petroleum-based, amounting to 67 percent of total energy production and resulting in a fuel imports bill that is the equivalent of 10.1 percent of GDP.[8]

The island has set RE and energy efficiency targets concerning policy and regulatory framework. It has also proposed introducing energy efficiency standards, restrictions on incandescent bulbs, appliance labeling standards, minimum energy performance standards, and building codes, but these have yet to be implemented.

Bonaire

Bonaire, another island that is part of the Kingdom of the Netherlands, has a RE installed capacity of 33 percent. Similar to Curaçao, it has nearly double the capacity of RE compared to Aruba. Wind energy is the primary source of RE in Bonaire at 33 percent, with solar contributing just 1 percent. Heavy fuel oils and diesel still account for 69 percent of total energy production. The reliance on fossil fuels has necessitated substantial fuel imports equivalent to 36 percent of GDP. With regard to existing policy and regulatory framework, Bonaire has a feed-in tariff, interconnection standards, and a renewable energy target in place.

St. Maarten

Another island connected to the Kingdom of the Netherlands is St. Maarten. This island currently has no RE installed capacity and relies 100 percent on diesel and fuel oil for its energy production. This diesel and fuel oil must be imported, such that the fuel import expense is equivalent to 9.4 percent of GDP.[9] With regard to the existing policy and regulatory framework, St. Maarten has only interconnection standards and RE targets in place.

Barbados

Barbados has a RE installed capacity share of 10.5 percent, just over half of the RE capacity currently installed in Aruba. The RE installed capacity in Barbados consists exclusively of solar energy. Oil and diesel provide the remainder of the electricity demand. The latter led to fuel imports amounting to 6 percent of GDP. In the area of policy and the regulatory framework, Barbados has made considerable progress. It has put in place a feed-in tariff, net-billing, interconnection standards,

[7] U.S. Department of Energy, Energy Snapshot Curaçao

[8] Based on CBCS Balance of Payment Statistics (Table 1-8) for 2020 and GDP estimates for 2020 in the IMF's Article IV Consultation Report for Curaçao and St. Maarten of August 2022.

[9] Based on CBCS Balance of Payment Statistics (Table 1-8) for 2020 and GDP estimates for 2020 in the IMF's Article IV Consultation Report for Curaçao and St. Maarten of August 2022.

tax credits related to RE and energy efficiency, tax reduction/exemption on RE and energy efficiency, public loans/grants, energy efficiency standards, minimum energy performance standards, and targets for RE and energy efficiency, among other policies.

Bahamas

The Bahamas has no RE installed capacity and is almost entirely reliant on imported fossil fuels. The share of 11.4 percent of GDP spent on fuel imports, which consist of diesel and heavy fuel oil, reflects the Bahamas' fuel dependency. With regard to existing policy and regulation, the Bahamas has restrictions on incandescent bulbs, RE targets, and energy efficiency targets. Meanwhile, feed-in tariffs and net metering are in development.

Dominican Republic

The Dominican Republic, one of the largest Caribbean nations, has an RE installed capacity of 24.3 percent of the total installed capacity, somewhat higher than the RE capacity currently installed in Aruba. Renewable energy generation comes mainly from hydro and wind, with small contributions from biomass and solar. The primary sources of energy production are still fossil-based, i.e., fuel, coal, and natural gas. Consequently, the Dominican Republic pays 3.5 percent of its GDP on fuel imports. The existing policy and regulatory framework includes a feed-in tariff, net metering, interconnection standards, tax credits for renewable energy, tax reduction/exemption for renewable energy and energy efficiency, public loans/grants, auctions or reverse auctions, energy efficiency standards, restrictions on incandescent bulbs, appliance labeling standards, minimum energy performance standards, and renewable energy targets.

Jamaica

Jamaica, also one of the larger Caribbean islands, boasts a RE installed capacity of 13.8 percent, lower than Aruba's share of RE installed capacity. Renewable energy sources consist of wind, hydropower, and solar. Fossil fuels, i.e., petroleum and liquid natural gas (LNG), comprise the lion's share of the energy mix at 89 percent. The dependency on fossil fuels results in fuel import payments equivalent to 7.4 percent of GDP. The island has several policies and regulations, including net billing, interconnection standards, tax reduction/exemption on renewable energy and energy efficiency, auctions or reverse auctions, green public procurement, energy efficiency standards, minimum energy performance standards, building codes, and renewable energy targets.

	Installed RE capacity (in %)	RE sources	Fuel imports (% of GDP)[1]	Existing policy and regulation
Aruba	19	Wind, solar	15	Net metering, interconnection standards, tax reduction/exemption on RE and energy efficiency, Green public procurement, RE target.
Bonaire	33	Wind, solar	36	Feed-in tariff, interconnection standards, RE target.
Curaçao	33	Wind, solar	14	Renewable portfolio standard, RE and energy efficiency targets.
St. Maarten	0	None	1.6	Interconnection standards, RE targets.
Barbados	10.5	Solar	6	Feed-in tariff, net billing, interconnection standards, tax credits on RE and energy efficiency, tax reduction/exemption on RE and energy efficiency, public loans/grants, energy efficiency standards, restrictions on incandescent bulbs, appliance labeling standards, minimum energy performance standards, and targets for RE and energy efficiency.
Bahamas	0	None	11.4	Restrictions on incandescent bulbs, RE and energy efficiency targets.
Dominican Republic	24.3	Hydro, wind, biomass, solar	3.5	Feed-in tariff, net metering, interconnection standards, tax credits on RE, tax reduction/exemption on RE and energy efficiency, public loans/grants, auctions or reverse auctions, energy efficiency standards, restrictions on incandescent bulbs, appliance labeling standards, minimum energy performance standards, RE targets.

[10] The source for these data, the U.S. Department of Energy, only provides ratios to GDP in its report and not USD values.

Jamaica	13.8	Wind, hydro, solar	7.4	Net billing, interconnection standards, renewable portfolio standard, tax reduction/exemption on RE and energy efficiency, auctions or reverse auctions, green public procurement, energy efficiency standards, minimum energy performance standards, building codes, and RE targets.

Table 5.2: Renewable energy in selected Caribbean countries

A comparison with several of its Caribbean peers reveals that Aruba is more or less in the mid-range with regard to RE installed capacity. On the other hand, Aruba has the highest outlays for fuel imports relative to GDP, except for Bonaire. The higher payments for fuel imports point to a greater vulnerability to price disruptions in the international oil markets. Like most other islands, Aruba sources its renewable energy from wind and solar, although some islands also utilize hydro and biomass. On the policy and regulation front, the comparison with the other islands shows that while Aruba has some policies in place, there is ample scope for additional policies and regulations to facilitate the adoption of renewable energy and increase energy efficiency.

5.3 The current energy mix in Aruba and its evolution

Energy production in Aruba is still based mainly on fossil fuels (HFO). However, since 2006/2007, the share of renewable energy sources increased to about 19 percent of total energy production (Figures 5.1 and 5.2). The main driver of higher renewable energy generation was the wind park at Vader Piet and, to a lesser extent, the solar parks installed at several locations on the island. Furthermore, households that have installed solar panels to produce their energy have added to renewable energy production (Figures 5.2 and 5.3). In addition, the WEB has invested in efforts to increase efficiency and reduce the use of HFO in production. Consequently, the daily use of barrels of HFO has lessened by 33 percent since 2005. Meanwhile, the imports of oil-related products have dropped from 9.1 percent of GDP in 2011 to 5.4 percent of GDP in 2021 (Figure 1).

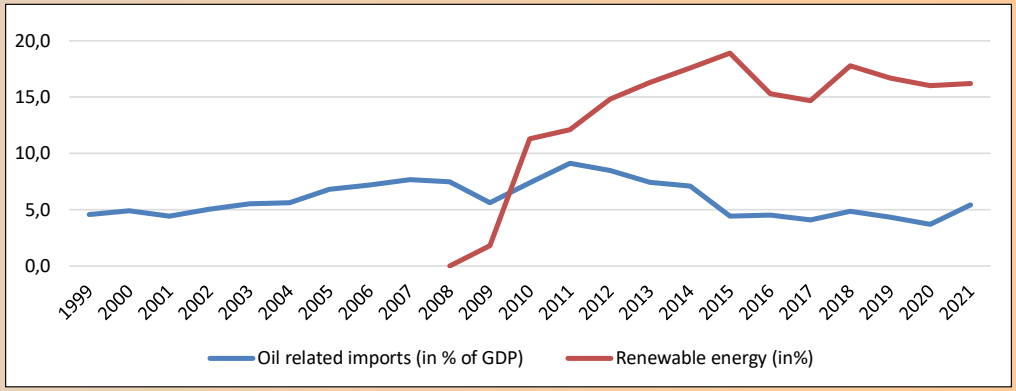


Figure 5.1: Oil-related imports and renewable energy
Source: CBA, CBS, and WEB. GDP figures for 1999-2018 are National Accounts data; figures for 2019-2021 are CBA estimates.

On the demand side, consumers have become more aware of energy efficiency and have taken steps to green their homes. They have increased the use of energy-efficient appliances such as inverter air conditioning, refrigerators, LED lighting, and insulation for the home. The government has introduced favorable import tariffs to stimulate the adoption of these products.

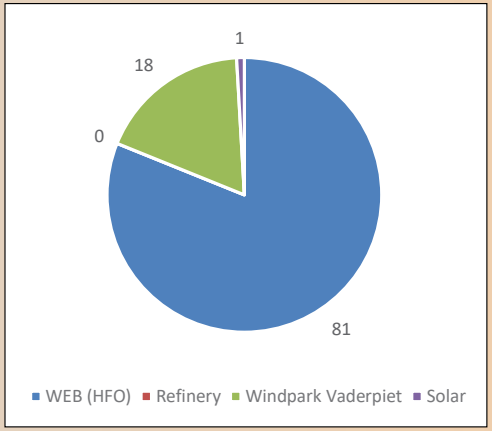


Figure 5.2: Share in total power production, April 2022
Source: WEB Aruba N.V.

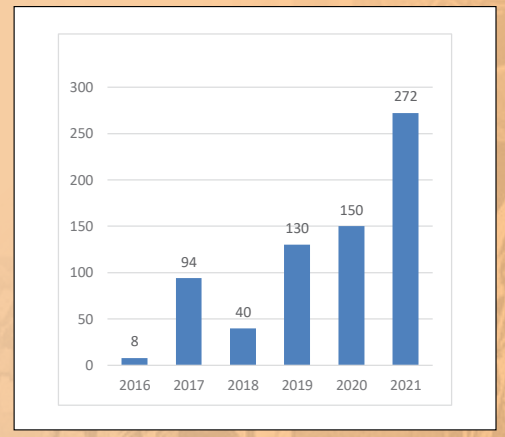


Figure 5.3: Number of approved solar panels
Source: DTI.

Turning to the transport sector, which accounts for 30 percent of Aruba's CO_2 emissions[11], the lion's share of the car park in Aruba still consists of internal combustion engine vehicles (ICE), indicating a need for significant gasoline imports (Figures 5.4 and 5.6).

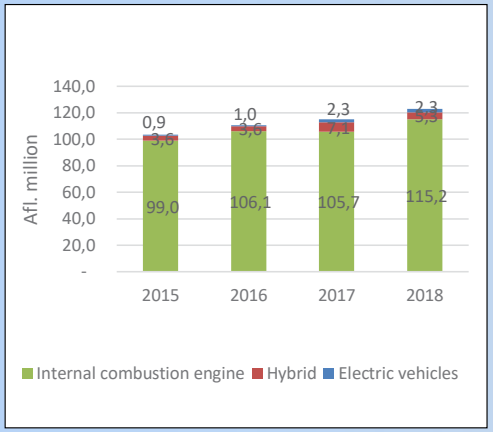


Figure 5.4: Car imports
Source: CBS.

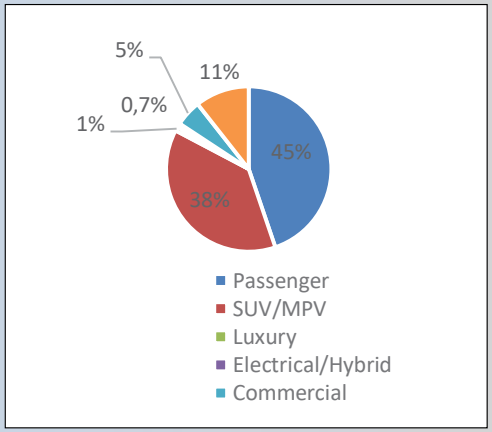


Figure 5.5: Share of car sales, 2021
Source: Aruba Car Dealers Association.

While the government has introduced lower import tariffs for electric and hybrid vehicles, these are still relatively expensive and constitute a tiny part of new car sales. In 2021, the sale of electric and hybrid vehicles at car dealerships in Aruba accounted for a mere 0.7 percent of total sales (Figure 5.5).

[11] Government of Aruba, Resolutions – Energy Summit III, December 2020.

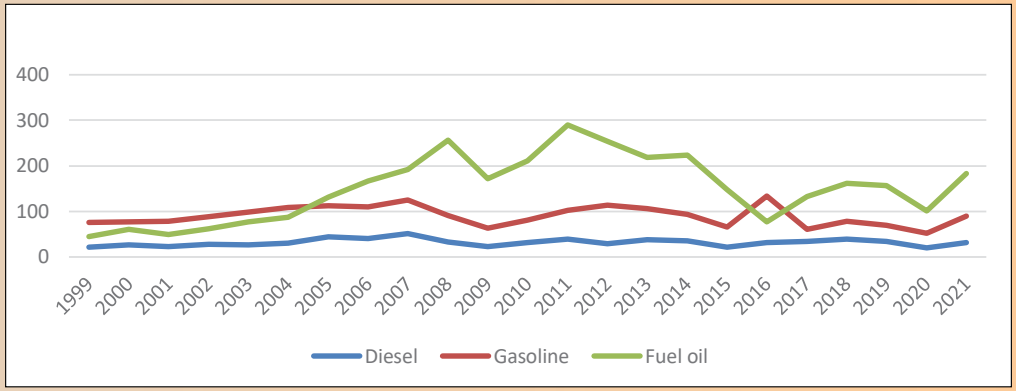


Figure 5.6: Imports of gasoline, diesel, and fuel oil
Source: CBA and WEB.

Higher costs are also an obstacle to purchasing more efficient home appliances, home insulation, and solar panels. In the case of solar panels, an additional impediment is the limitation in grid capacity. The electricity company (Elmar) caps the number of households in a given area that can install solar panels and connect to the grid.

5.4 The potential social and economic impacts of the energy transition for individuals and the Aruban community

Social

Despite a significant decline in their price in the past 10 years, renewable energy installations (e.g., solar panels) for residential use are still relatively expensive and less affordable for lower-income households. The government has lowered import tariffs on items such as solar panels. Nonetheless, due to the relatively high prices, these policies tend only to benefit higher-income households, while lower-income families remain excluded from this form of energy production. Generally, lower-income households spend a more significant proportion of their income on utilities. Without policies to make the transition inclusive, higher-income families can shift toward producing their energy from renewable sources and lower their energy bill. At the same time, lower-income households may have to pay an even greater proportion of their income on (fossil fuel) energy. The higher proportion of income paid stems from grid costs having to be covered by fewer users and the absence of higher-income households on the grid to subsidize tariffs for lower-income families. In the current situation, households using more energy pay higher utility tariffs to help subsidize lower tariffs for households with lower consumption. Households that consume more generally earn higher incomes.

The transition to renewables may impact employees working in the fossil fuel energy sector as demand for this energy source dwindles. For Aruba, this impact may be limited since, Aruba has no large industries that depend on fossil fuels. The

utility companies will likely continue to play a role in managing the power grid, albeit possibly with a different business model.

Economic

The shift toward renewables will reduce Aruba's fossil fuel dependency, lower (oil) imports, and lessen vulnerability to rising oil prices in the international market. This development will positively impact the current account of the balance of payments and eliminate this source of foreign exchange outflow. Of course, the initial investment needed to make the transition possible will likely also cause outflows of foreign exchange.

The transition to renewable sources also creates novel economic opportunities for new participants in the energy market. While the electricity company was traditionally the only player in the electricity market, several (small and medium-sized) companies are selling renewable electricity services now. In addition, customers will be able to play a more significant role as electricity services providers. With net metering, prosumers can produce and sell energy to the utility company. Moreover, advanced metering and communication technology can offer customers the opportunity to generate revenue through demand-response programs, which pay customers to reduce their energy usage.

Moreover, electric vehicle technology can also create economic opportunities for utility customers who would be paid to allow their car batteries to provide ancillary services to the grid. Advances in technology coupled with adaptation of relevant legislation could turn the electricity system into a source of revenue for utility customers rather than solely a source of essential services. However, many low-income electricity customers lack the resources to participate in these new electricity markets or otherwise benefit financially from the clean energy transition. Without access to capital and services that could enable the installation of clean and smart energy facilities, low-income customers will be excluded from the transitioning energy market.

A transition toward renewable energy sources, such as solar and wind, will increase Aruba's energy security. Aruba will produce the energy it consumes, no longer depend on the import of oil, and be vulnerable to recurrent disruptions in the oil market and related price fluctuations. Thus, the ability to provide energy to all its citizens will be much more firmly in Aruba's hands.

5.5 Potential challenges of the energy transition

In its Energy Resolution,[12] the Aruban government plans to attain a 50 percent renewable energy threshold by 2030. Achieving 50 percent is a vast but necessary task, given environmental sustainability factors and existing vulnerability to geopolitical risk and its impact on fossil fuel prices. Broadly speaking, there are two ways to reach this objective: a) maintain a central grid, which is very expensive in terms of investment, or b) allow decentralization of the energy transition, i.e., allow power users to access solar and wind energy and pay households and companies for the energy they produce. One problem with the latter option is that the companies and households that have now become producers will no longer subsidize the energy tariffs for lower-income households. Consequently, utility companies

[12] Resolutions - Energy Summit III, December 2020.

or the government of Aruba would bear the cost of solidarity. Alternatively, existing RE sources could be used to keep tariffs low for low-income households.

Table 5.3 provides an initial estimate of several of the costs and benefits associated with implementing the targets formulated in the government's Energy Resolution.[13]

	Current situation	2030 target	Target Δ 2030	Average yearly target Δ	Monetary value (in Afl. Million)
RE share	19%	50%	+31% points	+4.4% points	77.9
EV's	Less than 1%	15%	>+14%	> +2%	>876.1
HFO consumption	4016	<2000	-2000	-285.7	-115.2
Electricity consumption (*1000 KWH)	742.8	-15%	-111.4	-15.9	-46.1

Table 5.3. Estimation of costs and benefits of targets in Energy Resolution

In addition to the direct benefits of reaching Energy Resolution targets, there is also the indirect gain of reduced fossil fuel imports. Based on 2022 import data, a 50 percent share of RE in total energy production and an increase in EV's to 15 percent of all passenger cars will represent annual savings of, respectively, Afl. 85.1 million and Afl. 14.8 million in import outlays on fuel oil and gasoline. Moreover, raising the energy efficiency by 15 percent will generate an additional Afl. 20.6 million in savings on oil related imports (Table 4).

[13] The positive figures in the table denote additional investments/costs, while the negative signs denote savings.

	Current import of fossil fuels (Afl. million)	Fossil fuel imports when target is reached (Afl million)	Savings (Afl. million)
RE share of 50%	222.4	137.3	85.1
EV share of 15%	105.0	90.1	14.8
Energy efficiency +15%	-	-	20.6
Total savings			**120.5**

Table 5.4: Indirect benefits of targets in the Energy Resolution through savings on imports

As with other countries, the clean energy transition will also present challenges for Aruba. The following challenges were identified.

Required investments to reach clean energy goals

The investments required to realize the transition to clean energy are substantial. These investments entail investments in sustainable power generation and electrifying the transportation sector. While traditionally, utility companies financed investments in power generation in Aruba, the size of the required investments represents a significant burden and may slow down the pace of transition. The electrification of the transport sector will require a combination of government and private investments. The government will have to lead by example while also putting policies in place that stimulate private-sector investments. The investments in renewable energy sources will also have to be complemented by investments in energy efficiency on the demand side. Again, this will likely require combined efforts by the government and the private sector.

Physical space for the renewable energy infrastructure

Wind- and solar parks need a significant amount of physical space. Currently, Aruba has one wind park at Vader Piet and several solar parks that generate about 19 percent of Aruba's energy demand. Meanwhile, the Aruban government has outlined a renewable energy target of 50 percent by 2030. Therefore, it seems reasonable to assume that at least one additional wind park will have to be built on the island. Finding a space that is adequate from a technical perspective and is acceptable to nearby residents has proven difficult in the past and will likely remain so. The alternative of marine wind parks is difficult in Aruba due to the depth of the sea around Aruba and will require much more significant investments.

The business model of utility companies

Utility companies will likely have to change their existing business models. The centralized production model that has existed until now will probably have to switch to a decentralized model where consumers become producers of energy themselves - so-called prosumers. This paradigm shift from centralized, top-down control to distributed bottom-up control and even wholly decentralized peer-to-peer approaches may be necessary to achieve large-scale energy production from renewable resources. In addition, with renewable technologies becoming more affordable and efficient, large customers, i.e., hotels, at some point may demand cheaper and more efficient energy and no longer be willing to be part of the cross subsidizing of the energy use of households and small businesses. Moreover, individual consumers who can afford to do so may go off-grid. Consequently, the scale of utility company operations may become much smaller, whereby the focus shifts from producing to ensuring grid stability and maintenance and from charging by a unit of energy used to setting a grid fee. Apart from the potentially lesser need for personnel in this scenario, this development may also present challenges related to locked-in positions via a purchasing power agreement for LNG, existing debt to finance investments in fossil fuel technologies, and the risk of stranded assets.

Technical capacity of the electricity grid

The ability of the grid to handle various renewable energy sources has limitations due to the unstable nature of these energy sources. Absorbing renewable energy sources is not so much a problem at the macro level. Still, bottlenecks can appear at the neighborhood level, with a large concentration of households with solar installations. These constraints have prompted the current policy followed by the electricity company, which caps each neighborhood's solar capacity connectable to the grid. To enable more renewable energy production by consumers without the above restriction, investment is needed to expand grid capacity at these neighborhood levels.

Energy security concerns

The transition to renewables and low carbon technologies can bring new energy security concerns to the fore. These might include the tenuous state of supply chains necessary to secure transition materials (i.e., minerals) or the lack of flexibility in power grids. In addition, the diffuse and decentralized nature of renewable generation also raises the risk of cyber-attacks. An avenue currently being examined concerning power grid flexibility is how best to integrate intermittent renewable energy sources (IRES) into existing electricity grids while guaranteeing a reliable and steady supply. Moreover, clean energy power plants generally require more minerals to build than fossil fuel power plants; thus, securing the necessary minerals will be vital for energy security. The rising importance of minerals (which are in tight supply and whose production is dominated by a limited number of nations[14]) in a decarbonizing energy system requires energy policymakers to expand their horizons and consider potential new vulnerabilities. Concerns about price volatility and security of the supply do not disappear in an electrified and renewed energy system. Mitigation measures to address these concerns must be implemented at the outset. Thus, the

[14] www.iea.org, Energy Security: Reliable, affordable access to all fuels and energy sources.

energy transition entails a trade-off whereby environmentally unsustainable and volatile fossil energy sources are abandoned in favor of renewable energy sources with their own energy security risks.

Heightened market volatility and concentration in oil and gas markets

During the transition, reductions in oil and gas demand could decrease the supply due to a scaling back in investment in existing fields or a concentration of supply in fewer countries. If the reduction in supply happens faster than the fall in demand, oil and gas prices will rise, leading to higher costs for oil-importing countries.

Unavailability and higher costs of transition minerals

Uncertainty about the timely availability and cost of minerals in a clean energy environment are closely related to the energy security challenge. A rapid rise in demand for critical minerals can raise doubts about their availability and supply. Consequently, past strains on the supply-demand balance for different minerals have prompted additional investment and measures to moderate or substitute demand. But these responses have often come with time lags and been accompanied by considerable price volatility. Similar disruptions in the future could hamper clean energy transitions and push up costs. Moreover, current mineral supply and investment plans fall short of what is needed to transform the energy sector, raising the risk of delayed or more expensive energy transitions.

However, there are significant differences between oil security and mineral security, particularly in the impact of a disruption. During an oil supply crisis, all consumers driving gasoline-powered cars or diesel trucks are affected. In contrast, a shortage or spike in the price of a mineral affects only the cost of new EVs or solar plants. Consumers driving existing EVs or using solar-powered electricity are not affected.

5.6 Policy recommendations

Achieving inclusive and sustainable energy transition requires coherent and integrated policies. In general, policymakers should structure an integrated policy approach to contain four elements, including measures to:[15]

1. Mitigate the possible regressive impact of pricing environmental externalities for vulnerable households. Well-designed revenue recycling schemes that accompany price-based measures could help achieve this end. For example, a tax on carbon combined with a cash transfer to low-income households to alleviate the impact of the tax on these households.[16] Research on G20 countries suggests that a carbon tax of EUR 30 per ton could generate close to 1 percent of GDP in additional tax revenues (OECD, 2017).[17] Moreover, policy simulations suggest that only about a third of this revenue would be needed to mitigate the distributional implications of higher energy prices for households (Flues and van Dender, 2017).[18] The remaining funds could then be used to support

[15] OECD, 2021, The Inequalities-Environment Nexus Towards a People-Centered Green Transition.

[16] For more examples of carbon tax recycling schemes that alleviate the impact on vulnerable households please see Box 1.

[17] OECD (2017), Investing in Climate, Investing in Growth, OECD Publishing, Paris. https: //dx.doi.org/10.1787/9789264273528-en

[18] Flues, F., and K. van Dender (2017), "The impact of energy taxes on the affordability of domestic energy", OECD Taxation Working Papers, No. 30, OECD Publishing, Paris. https://dx.doi.org/10.1787/08705547-en

structural adjustment programs for workers and communities, and necessary green infrastructure investments. While it is likely that a larger portion of carbon tax revenues would be needed in Aruba, due to a higher degree of inequality than in G20 countries, we can still expect the revenues to cover the costs of supporting vulnerable households. Table 5.5 provides an estimate of the net revenue of a carbon tax scheme with revenue recycling if we assume similar distributional implications akin to those in G20 countries.

Carbon emissions (metric ton)	Carbon tax rate (in Afl.)	Carbon tax revenue (in Afl. million)	Cost to mitigate impact on vulnerable households (in Afl. million)	Net revenue available for support programs and green infrastructure investment (in Afl. million)
(1)	(2)	(3) = (1) * (2)	(4) = (3) * 1/3	(5) = (3) – (4)
1,001,563.5[19]	54[20]	54.1	18.0	36.1

Table 5.5: Net revenue estimation of carbon tax with revenue recycling

2. Achieve inclusive green growth with investment in human capital through active labor market policies, well-targeted income support measures, and upgraded skills to facilitate labor reallocation. Relevant Ministries such as the Ministries of Education, Environment and Labor should partner with relevant institutions, social partners, and the private sector to anticipate, identify, and provide the skills needed for green jobs and the low-carbon transition (ILO, 2016).

3. Address systemic inequalities with sectoral and place-based policies that facilitate social dialogue, social capital investments, social protection, skills, and education investments to ease the structural adjustment of local economies to the energy transition. Specific environmental policies that can stimulate an inclusive transition toward renewables vary from one region to another. For example, a resource-rich region may benefit from increased demand for

[19] Based on a per capita emission of 9.3 ton (Utilities Aruba, 2022) and the provisional mid-year population for 2021.

[20] Based on a carbon tax of USD 30 per ton, similar to the EUR 30 per ton tax in the OECD study.

minerals that underpin low-carbon technologies. On the other hand, a region specializing in energy intensive heavy industries may support the technological upgrade of these firms and invest in the required infrastructure for decarbonization and job creation. Climate change and air pollution control measures should take into account regional differences. Not doing so can increase discontent among local communities if the benefits and costs of environmental policies are dispersed geographically. Significantly, policy packages for a just green transition should vary from one region to another, as no "one-size-fits-all" green pathway is possible.

4. Ensure efficient and responsive governance to manage the inclusive green transition. As policies in different domains (e.g., energy, sustainability, utility, housing, transport) interact across the economy, long-term strategies can help strengthen coherency in favor of their alignment across several ministerial portfolios. Strategic long-term planning by the government is key because policy instruments will be most effective when underpinned by a clear long-term commitment by the government. This will foster confidence in the private sector and civil-society stakeholders needed to take on long-term investment decisions. Institutional mechanisms underpinned in legal provisions that last beyond electoral cycles can support the mainstreaming of environmental and equity considerations in policymaking and budgeting across ministries and levels of government. For example, France and the U.K. have passed climate laws that mandate the creation and implementation of Long-Term Low-Emission Development Strategies (LT-LEDS) along with carbon budgets up until 2050 (Aguilar Jaber et al., 2020[231]). Failure to reach these targets would lead to judiciary review by Parliament. Clear and regular entry points for civil society in the policy-making process would also help to enhance public acceptance of ambitious clean energy policies.
This section offers several recommendations specific to the Aruban situation and containing elements needed to achieve an inclusive and sustainable energy transition in support of economic growth.

Implement transitions policies that maximize job creation

Establishing clear and transparent long-term energy transition strategies helps to stimulate and lower the risk of private investment in clean energy sectors to support job creation. The government can achieve this by aligning industrial and climate policies to promote innovation and job creation in growing areas such as energy services, renewables, and smart technology. A potential strategy could involve attracting companies to produce solar panels, lithium batteries, solar charging infrastructure, and other advanced technologies in Aruba, similar to India's system.[21] Such a strategy would also be a step toward economic diversification, creating high-skilled jobs. To realize the necessary investment, the government should also try to leverage available funds from the "Landenpakket."

The government may elect to chart pathways for net-zero workforces, including quantifications of job potentials as this can facilitate the identification and understanding of future job opportunities and plan for education and skills needs. The IEA has shown that substantial investment in clean energy will boost GDP growth and create jobs. However,

[21] India's Make in India industrialization strategy aims to attract companies to advanced technologies in India.

government policies are needed to ensure a fair and equitable distribution of gains and losses.

An acceptable strategy is the reliance on fossil fuels that are less polluting, such as natural gas, during the transition. However, the government and utility companies should ensure that using natural gas and related contractual obligations do not hinder the transition to clean energy.

Develop tailored policies with a focus on skills and training

A successful transition to a clean growth economy will not only create new opportunities for workers but will depend on a skilled and agile workforce. Therefore, skills retraining and upskilling should be prioritized, with the necessary investment and engagement with educational institutions. In particular, digital upskilling will be essential for the clean energy jobs of the future. A stronger focus on education for younger people in clean energy fields is desirable in training the workforce of the future and ensuring its responsiveness to the evolving needs of jobseekers, workers, and employers. Examples of jurisdictions that have implemented programs focusing on retraining and upskilling include France, Italy, and the European Union.[22]

Use robust stakeholder engagement and policy coordination to deliver better outcomes

Achieving an inclusive energy transition requires buy-in from all stakeholders in society. From this perspective, it may be beneficial to engage in social deliberations with a wide range of stakeholders, including unions, employers, and the government. Doing so will help build public support, incorporate local perspectives, invite innovative ideas from diverse stakeholders, and help create sustainable, culturally appropriate, and feasible plans. It is also essential to communicate clearly to stakeholders the need for rapid transitions to avoid the risk of workers and companies becoming stranded in increasingly uncompetitive industries.

The energy transition has different aspects, so policy coordination across the government is essential. Addressing energy transition policies' economic and social impacts requires tighter coordination across government agencies, beyond just climate and energy ministries, to include finance, economic affairs and trade, transport, labor, agriculture, and education ministries.

Ensure that policies boost social and economic development and improve the quality of life for all.

Besides providing the clean, affordable energy required to protect the environment, stimulate economic development and growth, and improve quality of life, renewable energy infrastructure can be a significant driver for economic development in regions rich in renewable resources. To leverage the abundant sun and wind in Aruba, the government can designate certain regions as priority areas for clean energy investments. The former oil refinery could be a possible location for such a renewable energy zone. Governments that have taken this step include Australia and Turkiye.[23]

[22] IEA, Recommendations of the Global Commission on People-Centered Clean Energy Transition, p. 4.
[23] IEA, Recommendations of the Global Commission on People-Centered Clean Energy Transition, p. 6.

Clean energy, in combination with digital technologies, can significantly increase the daily comfort and convenience of households while also lowering energy bills. Globally, technological innovation has led to the increased use of smart home systems and mobile apps to track and manage energy consumption easily. These innovations have helped consumers conveniently lower energy bills. In Aruba, the electricity company has taken steps to make its grid smart and is in the process of rolling out smart meters for its clients. These are positive developments, and the electricity company should enhance these to the extent possible. In addition, the government should introduce building codes that include energy efficiency, minimum energy performance standards, green building certification programs, loan incentives for energy efficiency investment, and rebates. The need to comply with these building codes can spur technological innovation and the adoption of existing technologies by private companies. The associated investment is substantial. For instance, a rough estimate of the cost to install residential solar panels to meet the demand for household electricity consumption amounts to about Afl. 104 million.[24] The costs of increasing energy efficiency and performance still have to be added. These significant costs highlight the need to implement incentives and policies that stimulate the private sector to invest in the energy transition.

Another way the government can support innovation is by organizing competitions, such as the U.S. Department of Energy's "Apps for Energy" competition. Such policies would support innovation through, e.g., significant investment in home and building retrofits,[25] which can spark a wave of job creation. This investments can have multiple benefits; it can help Aruban residents make their homes greener and more affordable by lowering energy bills. Conversely, it can also help create jobs in small and medium-sized businesses that install more energy-efficient cooling equipment and insulation and increase the demand for energy auditors if these investments are coupled with energy efficiency requirements in the building code. Investments could create many jobs across various sectors such as construction, manufacturing, clean technology, and financial services, that will lead to overall positive experiences associated with clean energy.

Prioritize the elimination of energy poverty

While Aruba has (nearly) universal access to energy, its low-income households are at risk of falling into energy poverty. The average utility bill of households as a percentage of individual wage income surpassed the average utility spending by households according to the weight in the CPI basket[26] for 70 percent of individual wages during the period 2010–2020. While individual wages do not directly translate to household wages, the estimated number points to household vulnerability. In addition, the United Nations has identified the following groups in Aruba as being vulnerable to external shocks that could lead them into precarious living situations: unemployed men, women, and youth; single-parent

[24] This estimation is based on the average monthly sale of electricity to households for the period January-June 2022 and assumes an average price of Afl. 27,000 for the installation of a 10 KW solar system.

[25] IEA, Recommendations of the Global Commission on People-Centered Clean Energy Transition, p. 6.

[26] CBS, Income and Expenditure Survey 2016.

households; the elderly; persons living with disability; victims of domestic violence and abuse; people with various forms of addiction; undocumented migrants, refugees and stateless persons.[27] Multiple factors can lead to energy poverty: low incomes, high bills, and low-quality housing. The COVID-19 crisis has demonstrated the critical role of energy in daily lives, where energy deprivation means being unable to engage with society socially, economically, and politically. To ensure vulnerable households are not left behind, the government can implement policies that support these households for energy efficiency upgrades and retrofitting projects. Moreover, awareness campaigns on responsible energy use can also help curb energy demand and, thus, reduce energy poverty. The most straightforward way to finance these policies is through the introduction of a carbon tax combined with revenue recycling. As illustrated earlier in this section, net revenue from a carbon tax, after accounting for the sum needed to mitigate higher energy prices for vulnerable households, is estimated at Afl. 36.1 million. This amount would be available to support programs for vulnerable households.

Maintain and enhance energy security, affordability, and resilience

In light of the focus on energy security, the government should boost energy system resilience to pursue clean energy strategies. A move from imported fossil fuels to clean local sources can enhance broader economic resilience. It can also generate economic opportunities for Aruba to create industries around its clean energy resources.

The government should implement measures to increase energy efficiency. For example, the government could introduce fuel efficiency standards for passenger vehicles and heavy-duty vehicles, as Japan has done to significantly reduce its oil and gas imports.[28] Such efforts would bolster energy security by reducing Aruba's fuel import bill and its exposure to global supply disruptions. Lower energy bills from energy efficiency also make Aruban households less vulnerable to global price pressures. In addition, the government should actively promote renewable energy which would reduce energy imports and improve energy security.

While the shift to clean energy will reduce vulnerability to oil price fluctuations, it will create a new dependency on minerals needed for the clean energy infrastructure, such as copper, lithium, cobalt, etc. Aruba should try to secure these minerals from multiple source countries to deal with these dependencies. Also, the government and utility companies should diversify renewable energy sources to reduce the reliance on any particular minerals.

A critical component of the energy transition is the electricity grid, which will require investments to handle variable renewable energy sources and meet energy demand reliably. Utility companies must be financially healthy to make these investments or attract the necessary financing. Grids supported by variable renewable sources should be supported by storage, flexibility, and digital solutions. Additionally, investments in modernized grids and resiliency are needed. As climate change drives more weather-related disruptions to energy

[27] United Nations Caribbean, Country Diagnostic Study Aruba, p. 17.

[28] Energy security – Multiple Benefits of Energy Efficiency – Analysis - IEA, 2019.

infrastructure, strengthening the resilience of energy systems[29] will be even more critical. The latter requires, first and foremost, a clear assessment framework for climate impacts and resilience so that all stakeholders understand projected changes in climate. Subsequently, policies have to be implemented encouraging utility companies to include climate resilience in their construction plans and operational regimes. The inclusion of climate resilience can be inspired by identifying cost-effective resilience measures and creating an incentivization mechanism. Supportive policy measures can stimulate the adoption of resilience measures, such as physical system hardening, improvement in system operation, recovery planning, and capacity building.

Digitalization provides opportunities to enhance energy security but also introduces new risks, such as an increased scope for cyber-attacks. A successful cyber-attack could affect control of devices and processes, which could cause physical damage and widespread service disruption. Digitalization has advantages like improved energy planning, real-time monitoring, distributing energy resources to provide services to power systems, and responses to critical situations. However, the government must ensure that emergency preparedness and response capabilities remain robust in a more digitalized and electrified system by fostering digital security by implementing policy and regulation. To this end, electricity systems must become more cyber-resilient throughout the entire electricity value chain to withstand, adapt to, and rapidly recover from incidents and attacks while preserving the continuity of critical infrastructure operations.[30]

The perception of the impact of clean energy transitions on energy security and reliability is essential in determining people's experiences with clean energy. If clean energy policies are (mistakenly) associated with, for example, electricity blackouts, public support for clean energy policies can be weakened. Therefore, communication-related to these issues needs to be carefully managed. Unbiased assessments with reliable data can support this process.

Incorporate gender, equality, and social inclusion in all policies

Equality and inclusion in gender, social background, and socioeconomic status should be an explicit element of clean energy policy design. The objective is to avoid any risk of disproportionate or unintended consequences for specific segments of society, prevent exacerbating existing inequalities, and provide everyone with an opportunity to contribute to clean energy transitions. Not all consumers are the same. There is a need not only to look at the 'average' consumer but also at different consumer groups to address the risk that specific consumers can be excluded or negatively impacted by the energy transition. If policies do not focus specifically on equality, they can disadvantage more marginalized social sectors.

Moreover, they can be perceived as benefitting only the wealthier segments of society. Policies that promote equality and inclusion seek to remove barriers women face in pursuing a career in the clean energy sector and encourage their greater

[29] IEA conceptual framework of climate resilience: Climate resilience consists of the dimension's robustness, resourcefulness, and recovery. Robustness is the ability to withstand gradual changes in climate. Resourcefulness is the ability to manage operation during a disruption. Recovery is the ability to restore a system's function after a disruption.

[30] IEA, Power Systems in Transition

participation in the industry. These policies include initiatives to attract more women to STEM[31] programs aligned with the clean energy sector. This would occur via information campaigns in schools and universities, the creation of mentoring programs, opportunities for research scholarships in academy and industry, and opportunities for vocational apprenticeships (International Renewable Energy Agency (IRENA), 2013, p. 117). Further, women's pursuit of careers in the clean energy section would be encouraged.

Ensure fair distribution of clean energy benefits and avoid the risk of disproportionate negative impacts on vulnerable groups

All policies, particularly pricing and fiscal instruments which are central components of green policies, have distributional impacts and require careful design to prevent adverse effects or perceived unfairness. This design is essential since equity and justice are seen as vital components in ensuring the stability and feasibility of ambitious political plans to create a new energy regime and low-carbon society (Klinsky et al., 2017).

In the case of a carbon tax, the perceived fairness of its pricing would likely be higher when the government allocates corresponding tax revenues towards mitigating the impact on household finances, i.e., revenue recycling. Therefore, the government must design a carbon tax in a manner that alleviates the impact on vulnerable households and promotes fairness and equality. From the perspective of the budgetary constraints of the government and the aim of increasing equality, a budget-neutral option with targeted cash transfers to lower-income households is preferable.

In all its forms, a carbon tax or revenue recycling scheme will require extensive information sharing and careful communication, both before and after implementation, to ensure that the public perceives it as being fair and to enhance trust and acceptance.

Besides the costs, policies should also focus on the equal distribution of benefits among demographic groups. Some policies intended to stimulate the adoption of clean energy can favor owner-occupier households more than renters. For instance, subsidies for low-carbon technologies, such as those promoting the installation of rooftop solar panels, are primarily targeted at homeowners and are therefore potentially regressive.[32] Likewise, higher-income households are more likely to be able to buy electric vehicles and thereby benefit more from such subsidies. To avoid regressive policies, the government should combine these types of subsidies with policies that address the multiple barriers for low-income households to invest in clean technologies. Such obstacles can be overcome by designing policy measures to address housing affordability and greening of residential buildings. Examples include energy efficiency programs specifically aimed at low-income households and public spending on clean public transportation more often used by low-income families.

In light of equality and supporting vulnerable groups, existing fuel subsidies should be revised. In Aruba, fossil fuels are subsidized through water and electricity consumption in the form of limited or delayed pass-through of oil price fluctuations. Also, the tariff structure is based on usage - households that consume less pay a lower tariff when they consume below a certain threshold. A revision should verify whether vulnerable families are truly protected efficiently and

[31] STEM stands for Science, Technology, Engineering and Mathematics.

[32] OECD, 2021, The Inequalities-Environment Nexus towards a people centered green transition.

effectively in this way. Apart from the question of effectiveness, subsidies are often inefficient and foster perverse incentives for the wasteful consumption of polluting fuels. Targeted transfers to vulnerable households rather than subsidies are therefore preferable.

There are several ways to design a carbon tax that alleviates the impact on vulnerable households intending to promote fairness and equality. First, carbon taxes can be combined with lump-sum transfers provided to all households.[33] Since low-income families generally spend less in absolute terms on electricity bills than high-income households, carbon taxes with lump-sum transfers tend overall to be progressive, i.e., the compensation received by low-income families from the government surpasses the increased cost incurred.

Carbon tax revenues can also be redistributed through social cushioning. Social cushioning is progressive by design as it gives lower-income households a higher portion of the tax revenue. The government can perform this redistribution through generous income tax rebates or targeted lump sum transfers with eligibility based on household income.

Other forms of social cushioning include lump-sum transfers with the amount defined based on equivalence scales (for example, less weight could be given to children or the second adult in the household when redistributing revenues across eligible households). The government can also provide subsidy grants for low-carbon technologies with eligibility restricted to low-income households, subsidies for low-carbon options that low-income households are more likely to use (e.g., public transport), and subsidies to compensate low-income families not necessarily linked to low-carbon consumption (e.g., food stamps). Such policies ensure that the costs, benefits, and incentives are distributed fairly.

Another way to make a carbon tax progressive is through differentiated tax rates with threshold taxes. With this, carbon consumption below a designated level is exempt from the carbon tax. This option has the same effect as redistributing part of the revenues through lump-sum transfers.

Revenues from a carbon tax can also be recycled by earmarking the proceeds for investment in energy efficiency and, where needed, direct income support. The proposed Social Climate Fund by the European Commission is an example of such a system.[34]

Box 5.1 Options for carbon tax recycling that alleviate the impact on vulnerable households

[31] STEM stands for Science, Technology, Engineering and Mathematics.
[32] OECD, 2021, The Inequalities-Environment Nexus towards a people centered green transition.
[33] Carattini, S., Carvalho, M., Frankhauser, S., 2018, Overcoming Public Resistance to Carbon Taxing.
[34] European Commission, 2021, Proposal for a Regulation of the European Parliament and of the Council establishing a Social Climate Fund.

Integrate the voices of younger generations in decision-making

In keeping with an inclusive energy transition, it is desirable to get the participation of the Aruban youth. Younger generations will face the consequences of the clean energy transition decision taken today and represent a vital voice in the clean energy debate. Moreover, they have an internationally recognized right to participate in decision-making that impacts their future.[35] Therefore, the government should find ways to involve young voices in agenda-setting and decision-making. Around the world, several countries and organizations have installed platforms through which young people can share their perspectives on the energy transition.[36] Similar initiatives should be undertaken in Aruba. In addition, the government should provide funds for skills training, capacity-building, and tailored education programs to help young people prepare for jobs in clean energy sectors. Such initiatives are vital to accommodate the transition to the future labor market.

Involve the public through participation and communication

The chances of successfully implementing clean energy policies can be significantly improved by gaining broad public support at the beginning of policy design. Numerous countries' experiences have shown that platforms that enable public engagement in discussion and decision-making on climate action and clean energy transitions and encourage public recommendations that are given serious consideration can help to build trust and support. Therefore, citizens should receive opportunities to act as decision-makers, innovators, and beneficiaries of clean energy actions.

The government should also work to implement an effective communication strategy. Public information campaigns in several countries have shown that clear communication on the benefits and process of clean energy transitions can be crucial in enhancing citizen engagement and driving behavioral change. Moreover, clearly communicating the tangible benefits associated with energy efficiency and thereby increasing the positive association of the public with the energy transition can promote public acceptance of clean energy measures.

The government should also explore the feasibility of energy communities. The European Union defines a Citizen Energy Community as a legal entity that (a) is based on voluntary and open participation and is effectively controlled by members or shareholders that are natural persons, local authorities, including municipalities, or small enterprises; (b) has for its primary purpose to provide environmental, economic or social community benefits to its members or shareholders or to the local areas where it operates rather than to generate financial profits; and (c) may engage in generation, including from renewable sources, distribution, supply, consumption, aggregation, energy storage, energy efficiency services or charging services for electric vehicles or provide other energy services to its members or shareholders. Internationally, these communities play an essential role in clean energy transitions.[37] By actively engaging citizens in renewable energy projects, local resources can be

[35] UN Convention on the Right of the Child.

[36] European Commission, 2021, Youth for a Just Transition Toolkit.

[37] Roberts J., Frieden D., d'Herbemont, 2019, Energy Community Definitions.

pooled and local acceptance, access to capital, consumer choice, and local economic opportunities may be increased. Due to Aruba's small size, energy communities may not be feasible, but it is worth exploring.

Use insights from behavioral science to design effective behavior change policies

Evidence shows that well-designed policies based on behavioral science can trigger responsible energy consumption. This can be achieved through campaigns that focus on environmental protection and saving money, but the motivation for behavioral change can also come from ethics and values.

An essential first step in fostering consumer-driven action is raising consumer awareness by providing easily accessible and understandable data on consumption. For example, home energy reports provided by utility companies to consumers that include peer-to-peer comparisons have led to energy savings in several countries. In addition, feedback mechanisms have proven effective, e.g., emphasizing the financial savings from increased energy efficiency in a clear and straightforward manner. Policies that highlight benefits to consumers and businesses are necessary to address existing inertia and force of habit. They may also facilitate the adoption of more energy-efficient and climate-positive choices. In this context smart meters again have a role to play. Smart meter technologies are considered key enablers in realizing the full potential of renewable energy integration and consumers' active involvement in the energy transition (Bugden & Stedman, 2019). However, the information provided by smart meters is not enough. It needs to be accompanied by a motivation to conserve that may be provided by other instruments, such as financial incentives, goal-setting, or personal commitment (Valisjevska et al. 2016).

Behavioral science can also be utilized to promote the adoption of electric vehicles. Looking at policies implemented in other countries, Aruba should consider raising the import duties on ICE vehicles (especially those with higher emissions) and simultaneously exempt EV's from VAT[38] to make EV's more competitive with ICE's in terms of pricing. Moreover, other benefits can be bestowed on the owners of EV's, such as exemption/reduction from/of the equivalent of the motor vehicle tax, free parking (as opposed to paid parking for ICE vehicles), reduced company car taxes, and fiscal benefits for company cars falling only to EV's. In addition, the government can introduce special license plates for EV's to promote a shift in social norms toward driving EV's.

To incentivize the adoption of electric vehicles and energy-efficient home upgrades, the government can follow the lead of the U.S. government's proposed Inflation Reduction Act, which contains incentives for energy-efficient appliances and better insulation. It also provides tax credits to keep the price of residential solar panel installation artificially low. Moreover, the bill includes a tax credit to help consumers purchase electric vehicles, whereby anybody under a specified income threshold is eligible if the vehicle meets certain conditions. Meanwhile, the bill also contains rebates for the purchase of energy-efficient appliances, with rebate

[38] EV's are already exempt from import duties, i.e., pay 0% import duties.

amounts varying according to individual income. Additionally, the bill rewards homeowners who retrofit their homes and thereby reduce energy use - the rebate varies with the size of the reduction.

Finally, the government should lead by example and include green and inclusive development in its tendering procedures, rather than only cost considerations. Specifically, in its public procurement the government should only lease EV's and phase out all diesel buses in public transportation, replacing them with electric buses. Of course, to fully reap the environmental benefits of EV's the production of electricity should also be largely based on clean energy sources.

Invest in public transportation infrastructure

The transportation sector is currently an important source of CO_2 emissions and (fossil) energy consumption. In the Aruban context, there are potentially significant efficiency gains to be made. Apart from stimulating the transition from ICE vehicles to EV's, the government should invest in (sustainable) public transportation infrastructures to make public transportation an accessible and realistic option. This could reduce the number of vehicles on the road along with the consumption of fossil fuels. Additionally, since lower-income households make greater use of public transportation, these investments also reduce inequality. Besides public transportation investments, the government should promote ride-sharing as an added avenue to reduce energy consumption in the transportation sector.

Ensure that use of transition energy sources does not impede clean energy transition

Relying on fossil fuels that are less polluting, such as natural gas, during the transition is an acceptable strategy. However, the use of natural gas and related contractual obligations should not hinder the transition to truly clean energy.

Conduct a comprehensive cost-benefit-impact analysis of different scenarios and pathways towards energy transition

While it is beyond the scope of this study to provide a comprehensive cost and investment analysis for all the policies recommended here, Table 5.6 does provide rough estimates for selected policies and targets.

Policy/target	Cost (in Afl. million	Central Government	Private sector	Saving (in Afl. million)	Central Government	Private sector
Increase share of RE production to 50%	77.9	x	x			
Increase EV's to 15% of car park	>876.1		x			
Reduce HFO consumption to less than 2000 bpd				115.2	x	x
Increase energy efficiency by 15%				46.1	x	x
Install residential solar panels to meet household electricity demand.	104		x			
Carbon tax with revenue recycling				36.1	x	
Imports of fossil fuels after reaching targets				120.5	x	x

Table 5.6 Initial estimates for selected policies and targets.

5.7 Main findings and conclusions

The transition to clean energy presents a daunting challenge filled with both difficulties and a wide range of opportunities. Overall, the economic impact for Aruba is likely to be positive, leading to increased energy security and lower import bills, as well as new economic opportunities related to the clean energy sector. However, the energy transition also may exacerbate existing social inequalities, as renewable energy is still relatively expensive and not accessible for lower-income households.

To avoid the possibility of increased inequality, policies need to focus on equality and fairness. Moreover, a successful energy transition that achieves sustainability, inclusiveness, and economic growth requires integrated, coherent, and coordinated policies.

Aruba has already taken steps toward fostering wind and solar energy, reaching 19 percent of energy demand. However, the share of renewables in total power production has been stagnant for a number of years. In addition, in the transportation sector the vast majority of vehicles still runs on fossil fuels with EV's representing less than 1 percent of the car park. Consequently, Aruba still has significant outlays on the imports of fossil fuels and is susceptible to disruptions and price volatility in international markets. To illustrate, in 2022 imports of fuel oil, gasoline, and diesel amounted to Afl. 222.4 million, Afl. 105.0 million, and Afl. 54.2 million, respectively. In its Energy Resolution of December 2020, the Aruban government signaled its intention to ramp up renewable energy generation in the electricity sector, establishing a target of 50 percent by 2030, as well as increasing the energy efficiency of households and businesses to at least 15 percent by 2030. Also, the resolution defines a goal for the transportation sector, i.e., the adoption of EV's in the car park will be elevated to a minimum of 15 percent in 2030. The achievement of these targets will lead to an estimated Afl. 120.5 million in savings in annual imports of fossil fuels. The road to reaching these targets is challenging, but there are ways to get there. Besides the construction of additional wind parks, which is challenging due to the physical space needed, the government could choose to allow decentralization of the energy transition, whereby power users are allowed to access solar and wind energy and households and companies are paid for the energy they produce. In this way, the renewable energy targets may be more within reach.

Challenges include the significant investments by both private and public sectors required for sustainable power generation and the electrification of the transportation sector. An additional difficulty in Aruba is the limited physical space available to build wind and solar parks. Moreover, the technical capacity of the electricity grid to handle variable renewable energy sources due to the instable nature of these energy sources could present a constraint for the expansion of renewable energy. Another challenge may be posed by utility companies' ability to adapt their business models. To achieve large-scale renewable energy production, a paradigm shift from centralized top-down control to distributed bottom-up control and even completely decentralized peer-to-peer approaches may be necessary. Finally, the energy transition brings about new energy security concerns regarding the timely availability and cost of minerals in a clean energy environment and scarcity of oil and gas during the transition period.

The road ahead to clean and inclusive energy is long and hard. However, every long journey begins with a first step. To overcome the challenges and achieve a successful energy transition, this chapter has presented the following recommendations.

1.	**Implement policies that maximize job creation** - Align industrial and climate policies to promote innovation and job creation in growing areas such as energy services, renewables, and smart technology. - Outline pathways for net-zero workforces, including quantifications of job potentials, to anticipate future job opportunities and plan for education and skills needs.
2.	**Develop tailored policies with a focus on skills and training** - Prioritize skills retraining and upskilling with the necessary investment and engagement with educational institutions. - Place a stronger focus on education for younger people in clean energy fields and ensure that education is responsive to the evolving needs of jobseekers, workers, and employers.
3.	**Use robust stakeholder engagement and policy coordination** - Engage in social deliberation with a wide range of stakeholders, including unions, employers, and government. - Ensure strong policy coordination across government agencies.
4.	**Ensure that policies boost social and economic development, and improve quality of life for all.** - Designate certain regions as priority areas for clean energy investments. - Use technological innovation such as smart home systems and mobile apps to help consumers easily track and manage energy consumption and lower energy bills. - Introduce building codes that include energy efficiency, minimum energy performance standards, green building certification programs, loan incentives for energy efficiency investment, and rebates. - Organize competitions to stimulate innovation.
5.	**Prioritize the elimination of energy poverty.** - Implement policies that offer support to vulnerable households for energy efficiency upgrades and retrofitting projects. - Conduct awareness campaigns on responsible energy use to help curb energy demand and, thus, reduce energy poverty. - Finance these policies through the introduction of a carbon tax combined with revenue recycling.
6.	**Maintain and enhance energy security, affordability, and resilience.** - Boost energy system resilience in the pursuit of clean energy strategies. - Implement measures to increase energy efficiency and actively promote renewable energy. - Secure minerals needed for clean energy infrastructure from multiple source countries and diversify renewable energy sources to reduce the dependency on any particular minerals. - Ensure utility companies are in a financially healthy position to make necessary investments or attract financing to enhance its capability to handle variable renewable energy sources and meet energy demand in a reliable manner. - Enhance the resilience of energy systems to weather-related disruptions by implementing policies that encourage utility companies to include climate resilience in their construction plans and operational regimes. - Implement policy and regulation that foster digital security to ensure that emergency preparedness and response capabilities continue to be robust in a more digitalized and electrified system. - Communication related to the impact of clean energy transitions on energy security and reliability needs to be carefully managed. Unbiased assessments with reliable data can support this process.
7.	**Incorporate gender, equality, and social inclusion in all policies.** - Equality and inclusion should be an explicit element of clean energy policy design to avoid any risk of disproportionate or unintended consequences for certain segments of society, prevent exacerbating existing inequalities, and

	provide everyone with an opportunity to contribute to clean energy transitions.
8.	**Ensure fair distribution of clean energy benefits and avoid the risk of disproportionate negative impacts on vulnerable groups.** - Design a carbon tax in a manner that alleviates the impact on vulnerable households and promotes fairness and equality. From the perspective of the budgetary constraints of the government and the aim of increasing equality, a budget neutral option with targeted cash transfers to lower income households is preferred. - Provide extensive information and careful communication, both before and after implementation of a carbon tax, to ensure that it is perceived as being fair and to enhance trust and acceptance. - Besides the costs, policies should also focus on the equal distribution of benefits along demographic groups. To avoid regressive policies, subsidies intended to stimulate the adoption of clean energy should be combined with policies that address the multiple barriers for low-income households to invest in clean technologies. Such barriers can be overcome by designing policy measures to address housing affordability and greening of residential buildings. - Existing fuel subsidies should be revised and targeted transfers to vulnerable households instead of subsidies are preferable.
9.	**Integrate the voices of younger generations in decision making.** - Involve young voices in agenda-setting and decision-making by installing platforms through which young people can share their perspectives on the energy transition. Additionally, provide funds for skills training, capacity-building, and tailored education programs to help young people prepare for jobs in clean energy sectors.
10.	**Involve the public through participation and communication.**
	- Set up platforms through which the public is engaged in discussion and decision-making on climate action and clean energy transitions and recommendations are seen to be given serious consideration. - Implement an effective communication strategy that clearly communicates the tangible benefits associated with energy efficiency. - Explore the feasibility of energy communities.
11.	**Use insights from behavioral science to design effective behavior change policies.** - Raise consumer awareness by providing them with easily accessible and easily understandable data on consumption. - Implement policies that make benefits visible to consumers and businesses and incentivize them to address existing inertia and force of habit, and to help them adopt more energy-efficient and climate-positive choices. - Promote the adoption of EV's by introducing policies that make EV's more competitive with ICE's in terms of pricing. - Introduce legislation that incentivizes the adoption of EV's and energy-efficient home upgrades. - Government should lead by example in its public procurement by only leasing EV's and phasing out all diesel buses in public transportation, replacing them with electric buses.
12.	**Invest in public transportation infrastructure.** - Invest in (sustainable) public transportation infrastructure to make public transportation an accessible and realistic option.
13.	**Ensure that use of transition energy sources does not impede clean energy transition.** - Make sure that care is taken that the use of natural gas and related contractual obligations do not hinder the transition to truly clean energy.
14.	**Conduct a comprehensive cost-benefit-impact analysis of energy transition scenarios and pathways.**

Table 5.7 Recommendations for an inclusive energy transition

The preceding recommendations can be captured in a 3-layer roadmap that indicates the conditions that have to be met to achieve an inclusive energy transition. Figure 7 illustrates this roadmap in pyramid form with the base representing the general conditions that have to be met before moving up to the middle of the pyramid that contains more specific conditions necessary to reach the top where the inclusive energy transition is attained.

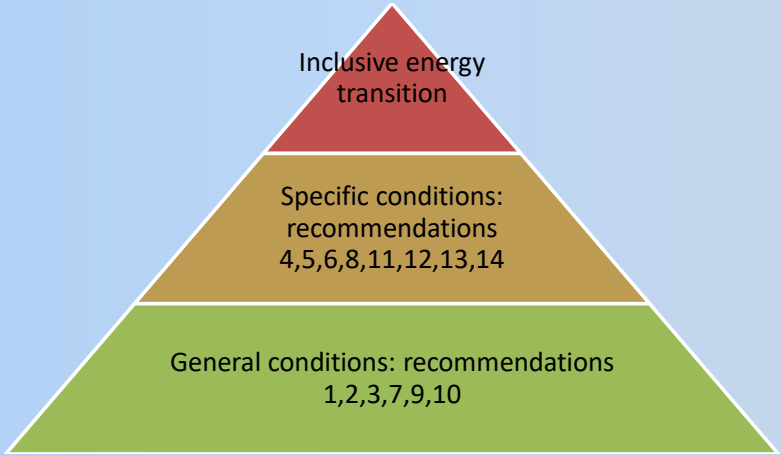


Figure 5.7: 3-layer roadmap to inclusive energy transition

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6.

Affordable Housing for Inclusive Development: An Exploratory Study of Housing Affordability in Aruba

Ryan R. Peterson, PhD

Executive Summary

The pursuit of affordable housing is central to sustainable development. *Affordable housing is fundamental to inclusive development and socioeconomic wellbeing. Over the past decade, and especially in the aftermath of the Global Financial Crisis, an unaffordable housing crisis surfaced, largely exacerbated by a surge in foreign real estate investments, the rise of the vacation home rental market, as well as house price appreciation, yet stagnant wages and sticky household income, in addition to the financial crisis stemming from the COVID-19 pandemic. This working paper addresses the affordable housing problematique and explores various demand and supply drivers, as well as their impacts on housing affordability in Aruba.*

The general findings indicate that housing in Aruba has become increasingly unaffordable for residents, particularly in certain regions, and, more importantly, for low- to middle-income households. *Whereas median house prices have appreciated considerably, median household income levels remain relatively stagnant, thereby engendering exclusive housing to the detriment of inclusive development. The results show that over the past decade, the affordability gap between house prices and household income levels has widened structurally.*

The median house price appreciated seven (7) times faster than the average growth in median household income, thereby further aggravating the growing problem of unaffordable housing in Aruba. *More specifically, the incipient housing affordability crisis is attributed to a confluence of several structural shifts and demand shocks, including (i) population growth mainly stemming from immigration, (ii) accommodative credit conditions due to favorable housing mortgage rates, as well as (iii) an upsurge in foreign investments in residential real estate, and (iv) a burgeoning vacation home rental market. Moreover, from a housing supply perspective, (v) the increasing costs of house construction and price of (limited) available land, along with (vi) an undersupply in available and affordable housing are compounding factors.*

Considering the precarious state of unaffordable housing, as well as the projected deficit growth of affordable housing for 2040, several structural policy shifts are urgently required and recommended. *These structural policy shifts underscore the need for governing affordable housing from the future in an integrated and sustainable manner. There is, however, no single 'silver bullet solution' to resolving unaffordable housing. Taming the unaffordable housing tide and bolstering affordable housing supply – for current and next-gen household – requires a sustainable 'Aruban Urban Agenda 2040' (AUA40), guided by principles for (economic) inclusion, (social) responsibility, and (ecological) resilience. Not only does affordable housing matter for fostering inclusive development; it is the heart of the matter.*

Keywords: Affordable housing, Housing affordability, Housing demand, Housing supply, House prices, Foreign residential real estate investment, Vacation home rentals, Inclusive development, Leading inclusive resilience.

1. Introduction

"The home is the foundation of sanity and sobriety; it is the indispensable condition of continuity; its health determines the health of the society as a whole."

Sir Robert Menzies

Housing matters. Housing is a basic human need and serves as a foundation for democracy (Organisation for Economic Co-operation and Development/OECD, 2021; United Nations/UNHabitat, 2020). Affordable housing is a critical factor for economic inclusion (International Monetary Fund/IMF, 2021; United Nations/UNHabitat, 2020). Over the past decade, a slew of developments, including, on the one hand, accelerated urbanization and 'Airbnbization', rising house prices, insufficient (residential) construction, scarcity of land, yet, on the other hand, income shocks, stagnant wages, and sluggish household income growth have spurred a growing housing affordability crisis (World Economic Forum/WEF, 2022) in which the gap between household income and housing costs has steadily widened (OECD, 2021; IMF, 2021). The United Nations (UNHabitat, 2020) concludes:

"In the last decades, affordability has become a global issue, which directly affects the wellbeing of people. Housing is increasingly a matter of concern for European citizens. In Latin America, high house price-to-income ratios and inaccessible housing finance have increased housing poverty. In many parts of Sub-Saharan Africa, less than 10 per cent of households can afford a mortgage. In the Organisation for Economic Co-operation and Development (OECD) region, housing prices grew three times faster than incomes in the past 20 years. Consequently, the housing affordability crisis has exacerbated urban inequalities. The lack of affordable solutions often pushes people, and particular social groups, such as low-income households, young people, and the elderly, into sharing overcrowded and unsafe dwellings, or moving into areas with little access to employment and education opportunities, healthcare, or green spaces. The challenge of making houses more affordable is made even more urgent by the growing income instability triggered by COVID-19." (UNHabitat, 2020).

In similar vein, the OECD (2021) indicates that housing has become an increasingly pressing economic, social, and environmental challenge in many countries. Soaring house prices have eroded housing affordability and resulted in social exclusion. According to the OECD (2021), households in many OECD countries find it increasingly difficult to access affordable housing. House prices have risen faster than average household incomes. Consequently, households have borrowed more to buy their home, resulting in additional burden of mortgage servicing. In general, housing costs have been on a steep rising trend over the past decade. The OECD (2021) observes that housing affordability has become particularly challenging for households on low to middle incomes, particularly for households that faced adverse income shocks or job losses as a result of the COVID-19 pandemic.

[1] *The terms affordable housing and social housing are often confused and used interchangeably. While affordable housing encompasses social housing, social housing refers specifically to affordable housing that is (a) targeted at low-income households and may be (b) subsidized by government. Consistent with previous studies, this research focuses on affordable housing for low- to median-income households and hence covers housing affordability beyond solely low-income households.*

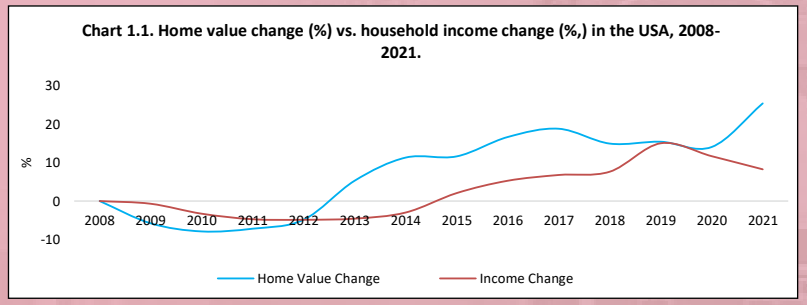
It is a truism that the lack of affordable housing[1] – the central problem of contemporary housing policy – has risen to the top of many national policy agenda's and has been elevated to a global urban housing crisis (IMF, 2021; Kallergis et al., 2018; OECD, 2021; WEF, 2022). Already in 2018, in a joint statement to the United Nations, the cities of Amsterdam, Barcelona, London, Montreal, Montevideo, New York and Paris declared that citizens' rights to affordable housing were being jeopardized following the growing influence of foreign real estate investors and mass tourism on urban property markets. In fact, several countries, including Canada, The Netherlands, the United Kingdom, the United States of America (see Box 1), as well as small island economies in the Dutch Caribbean (CBS NL, 2021), report that housing has become increasingly less affordable for residents. According to the World Bank (2021), 1.6 billion people are expected to be affected by the global housing shortage by 2025. The IMF (2021) concludes that the socioeconomic disparities resulting from the housing affordability problematique are likely to intensify over the next decade.

Initial reports indicate that housing has become unaffordable in Aruba. More specifically, preliminary market research suggests that at least 35 percent of residents – especially younger generations, including Gen Z (35 percent) and Millennials (50 percent) – are concerned about surging market prices and the increasing unaffordability of housing for locals (Aruba Tourism Authority - ATA, 2022). Aruba's spatial development plan (ROPV, 2021) highlights the structural lack of (affordable) housing, partially due to the systemic lack of adequate housing supply. These observations are echoed by the Fundacion Cas pa Comunidad Aruba (FCCA, 2021), reporting structural increase in requests and registrations for social housing over the past decade. Furthermore, the Centrale Bank van Aruba (CBA, 2021) stated that the average housing (debt) burden increased markedly by almost 10 percentage points between 2017 and 2021, partially due to the household income shock stemming from the COVID-19 pandemic. In terms of household financial wellbeing, close to 20 percent of households describe being financially distressed with a debt burden between 51 percent and 75 percent. Alternatively, less than 20 percent of households are considered financially fit and stable (CBA, 2021). The amalgam of these aforementioned findings indeed suggests the waning of affordable housing in Aruba.

Box 1. House affordability problematique (Source: CBS NL, 2021; CBS CUR, 2021; Delgado, 2021; Real Estate House Price to Income study, FRED).

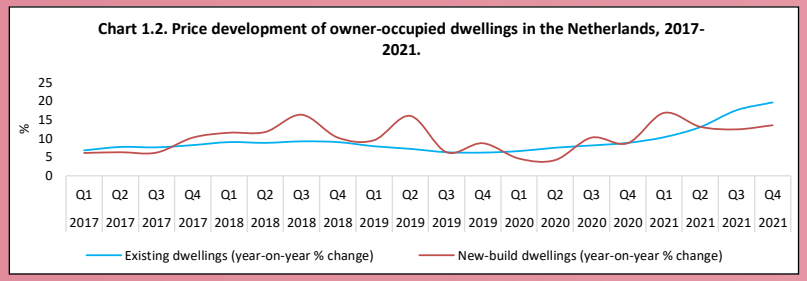
The United States of America (USA)

In the USA, home prices have soared by 118 percent since 1965, while median household income has increased by just 15 percent. Home prices have increased 7.6 times faster than income since 1965 and 3.1 times faster than income since 2008. To afford a home in 2021, Americans needed an average income of $144,192, yet the median household income was $69,178. The average house-price-to-income ratio is 5.4, more than double the recommended ratio of 2.6. From 2019 to 2021, the pandemic drastically increased the average house-price-to-income by 14.9 percent.



The Netherlands

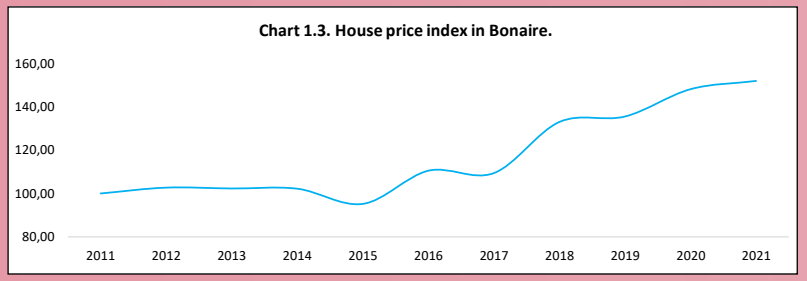
On average, house prices in the European Union rose by 10.0 percent in Q4 2021. With an 18.7 percent increase, the Netherlands is among the top five countries in the EU with the largest house price increase. In Q4 2021, the price of a newly built home was on average 13.5 percent higher than in the same quarter of the previous year. This is the sharpest year-on-year price increase in over 20 years.



Bonaire, The Dutch Caribbean

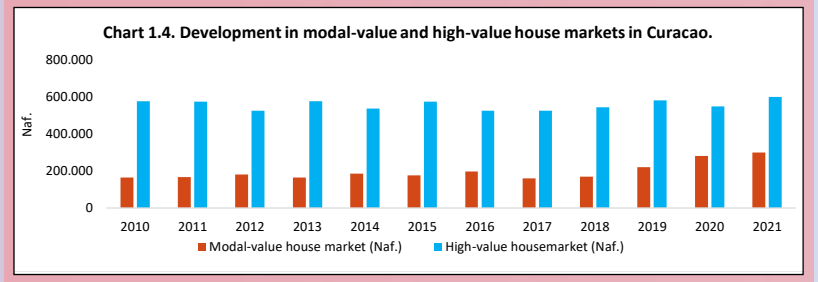
Recent reports on the housing market in Bonaire (CBS Netherlands) show that the sharp rise in house prices remains unabated. Compared to 2011, median house prices have surged by at least 50 percent. In addition to prices, the number of homes sold stood at 266 in 2021; an increase of 46.2 percent compared to 2020. The sharp rise in transactions is also reflected in the total home sales value, i.e., US$ 96 million, up from US$ 66 million in 2020. With median house prices starting at US$ 225,000 and annual median household income levels estimated at $44,000, housing is severely unaffordable for low- to middle-income families. The price-to-income ratio is estimated at 5.1, almost twice the recommended ratio. According to local reports, "due to the surge in house prices, families with even a median income find it difficult to find a house.

Many newcomers who buy a house in Bonaire are mainly European Dutch, with much more equity or an above-average income" (Evertsz, 2022). During a recent visit to Bonaire, the State Secretary Ms. Van Huffelen concluded that "the concerns are mostly directed towards individuals who live below the poverty line, the lack of a guaranteed stream of income, and the lack of affordable housing." (Severijnse, 2022).



Curacao

Between 2010 and 2021, the housing market in Curacao experienced substantial growth. Annual growth of house sales averaged close to 6 percent per annum. This rise was mainly prompted by an increase in the number of transactions in the residential market segment with a value of NAf. 350,000 and higher (an average annual growth of 4.3%). According to the CBS, this housing market segment is spurred by several factors, including an increasing influx of foreigners purchasing homes (to live in permanently or as a second home), especially from the Netherlands, in addition to housing developments resulting from the COVID19 pandemic. Recent studies indicate that certain neighborhoods in Curacao are increasingly experiencing the negative impacts of gentrification (Casper & Krea, 2020).



Consistent with reports by the UN and the OECD, research by the International Monetary Fund (IMF, 2021) shows that house prices have grown at a higher rate than household income levels across numerous countries (see Figure 1). The United Nations (UNHabitat, 2016) reports that less than 15 percent of the world's cities have affordable housing. In 2016, the UN initiated 'The Shift', a global movement bringing together all levels of governments, civil society, different institutions, and academia to reclaim the fundamental human right to housing. The aim is to move away from housing as a place to park excess capital, reinforcing inequality, and the concentration of wealth. The Shift is pivotal to the UN Sustainable Development Goals (UNSDGs), which, amongst others, aims to ensure access for all to adequate, safe and affordable housing by 2030 (UNSDG 11).

Furthermore, the middle class is being squeezed out of the housing market. The OECD (2021) finds that the middle-class faces ever rising costs relative to income and that its financial wellbeing is threatened. They conclude that the cost of essential parts of the middle-class lifestyle have increased significantly, i.e., house prices grew three times faster than household median income over the last two decades (OECD, 2021). Moreover, the COVID-19 pandemic has disproportionally impacted contact-intensive service sectors (e.g., tourism and hospitality sectors), wherein workers tend to be relatively less skilled, are hired more frequently under temporary contracts (often seasonally), and generally earn[2] relatively less than the median national income (IMF, 2021).

The affordable housing problematique is, however, by no means a novel phenomenon. During the Great Depression in the 1930s, several national housing policies and Federal Housing Acts were established as part of the New Deal to provide affordable and public housing for low- to middle-income households (McDougall, 1987). After the second World War, Faber & Faber (1964) concluded that failure to settle the problems of affordable housing was a threat to financial stability and urban housing poverty would become the most significant social problem in the 21st century. Linneman & Megbolugbe (1992) point out that the main focus of housing policy studies has gradually shifted over the past half-century, from poor housing quality (1950s) and housing scarcity (1960s), to homeownership (1980s) and housing affordability (1990s). The latter was underscored by the World Bank and the United Nations during the 1990s. Reminiscent of the 1960s (Faber & Faber, 1964), the European Central Bank (ECB, 2020) states that house price booms – in the absence of sound housing and macroprudential policies, as well as stagnant household income levels – are a recipe for financial crises. Likewise, the IMF (2021) recently concluded that stagnant incomes of many households contribute to an affordable housing squeeze, especially for middle-income households. Although today's standards of living have improved markedly in comparison to the previous century, the underlying structural causes remain largely similar, i.e., the broadening gap between what people earn, and what it costs to purchase and own a house.

[2] *Based on official wage earnings and income from formal employment.*

Figure 1. Growth-rate gap between house prices and household income levels 2021 (Source: IMF).

Building forth on international affordable housing policies and empirical studies, and drawing from several primary data sources and secondary data archives, this study explores the past, the present, as well as initial projections of affordable housing in Aruba. Underscoring the main theme of this Government Policy Study (GPS) – Leading inclusive resilience – and based on the OECD's Policy framework on Horizontal Project on Housing (OECD, 2021), as well as the UN's Policy for Affordable Housing 2030 (UN, 2021), this study addresses the following dimensions of housing affordability:

1. ***Inclusion*** relates to the possibility for low- to middle income households and other vulnerable groups, such as younger generations (i.e., first-time home seekers) and the elderly, to live in good-quality dwellings. Inclusion underscores the need for inclusive development, i.e., economic growth that is distributed fairly across society and creates opportunities for all;
2. ***Responsibility*** describes the responsiveness and capacity of the public and private housing sector to supply housing that meets the demand for affordable housing in an efficient, effective, and future-ready manner. Access to affordable (housing) finance plays an important role to foster financial inclusion and financial stability;
3. ***Resilience*** refers to the (adaptive) capacity for sustainable and affordable housing development within the context of the UNSDGs, including especially, 'Sustainable Cities & Communities' (SDG 11), 'Decent Work & Economic Growth'[3] (SDG 8), 'Life on Land' (SDG 15), 'Affordable and Clean Energy'[4] (SDG 7), and 'Climate Action' (SDG 13).

2. The Concept and Measurement of Affordable Housing

2.1. Affordable housing for inclusive development

Affordable housing is a cornerstone of social and economic development through its wide-spread impact on savings, investment, and employment, in addition to fostering economic wellbeing (Harris & Arku, 2005; IMF, 2021; UNHabitat, 2020; Van den Berg et al., 2013). Housing expenditures constitute the single largest household costs. Many housing-related activities contribute directly to achieving broader socioeconomic development goals (see Figure 2). Economically, housing investment is a major driver of economic growth. In prosperous times, affordable housing builds wealth by appreciating in value, providing a hedge against inflation, and sustaining secure premises for income-generating activities, as well as opening the door to credit (Kissick et al., 2006). From a social perspective, housing – after food and utilities – is the first need of vulnerable populations following natural and man-made disasters. There is a well-established body of literature showing that the benefits of housing for individuals and families accrue directly and indirectly through better health and wellbeing. Housing also generates multiplier effects in terms of employment and output. Furthermore, there is a symbiotic relationship between housing finance (i.e., housing mortgages) and financial sector development (Van der Berg et al., 2013).

The pursuit of affordable housing is central to sustainable development. The right to housing is reflected in the Universal Declaration of Human Rights (Article 25) and is integral to realizing the United Nations Sustainable Development Goals (UNSDGs, 2021).

[3] The importance of decent and inclusive work is addressed in Chapter 2 of this Government Policy Study.

[4] The transition to affordable and clean energy are discussed in Chapter 5 of this Government Policy Study

SDG 11 describes the goal to make cities and human settlements inclusive, safe, resilient, and sustainable. More specifically, the SDG target 11.1 calls on countries to *"ensure access for all to adequate, safe, and affordable housing and basic services by 2030"* (UNSDG, 2021). Furthermore, SDG target 11.3 emphasizes the need to "enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries by 2030" (UNSDG, 2021). However, whereas over 150 countries have developed national urban and housing policies over the past decade, less than 15 percent of countries have implemented plans (UNSDG, 2021). In fact, in the case of Aruba, and despite a general acknowledgement of a long-standing demand for adequate and affordable housing (FCCA, 2010), in addition to sustainable urbanization (ROPV, 2021), a recent Aruba SDG report shows that SDG targets 11.1 and 11.3 remain largely unattended and 'out of reach' (SDG Indicator Working Group, 2021). Thus, the need for affordable housing and sustainable housing policies must take center stage on the national policy agenda.

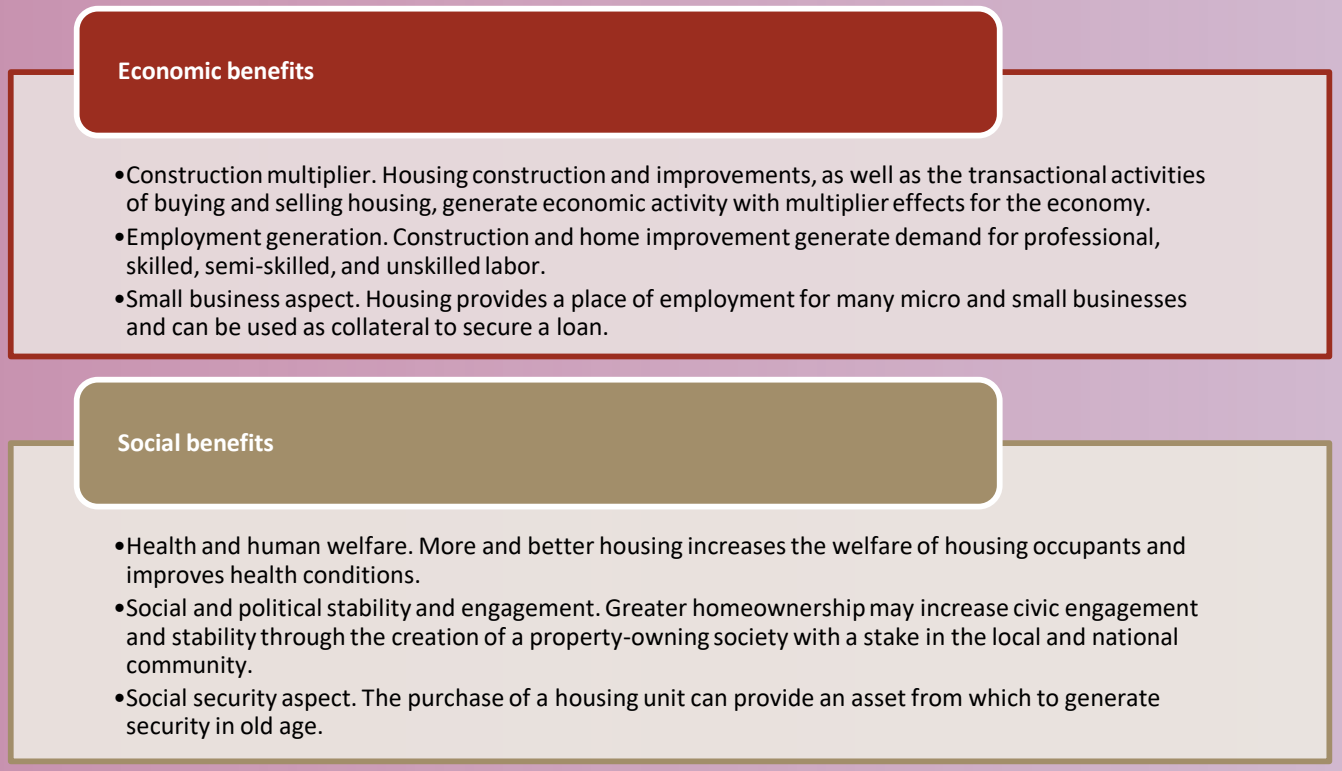


Figure 2. Economic and social benefits of housing for economic development (Source: Van den Berg et al., 2013).

In the wake of the COVID-19 pandemic, the UN asserts that unless structural housing reforms are swiftly executed, it is unlikely that SDG 11 will be achieved. Moreover, quality of life has deteriorated, and climate change vulnerabilities are increasing, according to the UN (UNSDG, 2021). Recent reports by the Inter-American Development Bank (2016) suggest that this alarming situation is no different across the Caribbean, citing the unsustainably high rate of urbanization, increasing prices of land and housing, (social and spatial) inequality, and the pressures on urban infrastructure networks. These challenges are particularly acute when considering that at least 60 percent of the population and primary (tourism-related) economic activities are located in coastal areas that are prone to climate change in the Caribbean (IDB, 2021).

Moreover, in the case of small island tourism economies (SITEs), the (uncontrolled) surge of 'home-sharing' and vacation home rentals (VHR) markets are crowding out residential housing markets. This foreign demand shock exacerbates an already precarious state of affordable housing, and consequently, adversely affects inclusive development. With the acceleration of the sharing economy, the unregulated expansion of VHRs deepens the affordable housing crisis by simultaneously distorting housing supply and demand (IMF, 2021). There is mounting scientific evidence that in the absence of appropriate regulation and enforcement, the VHR market results in multiple negative externalities, including but not limited to, social displacement, neighborhood gentrification, missed tax revenues (for government), informal/unregistered employment, and unlevelled competition vis-a-vis the (traditional) accommodation industry, i.e., hotels and time-share resorts (Garcia, 2022; Lee, 2021; Merante & Horn, 2016; Nieuwland & Van Melik, 2018; Zou, 2019).

What drives the recent tide in VHR tourism? Although not a new phenomenon – guesthouses have been purchased and owned by visitors and non-residents in the Caribbean since the 1950s –, the rapid rise in the VHR market is driven by several interrelated factors, including, e.g., the heightened pent-up travel demand and investment opportunities, the (post-lockdown) 'escape' from crowded cities, as well as the increase in tourism destinations offering easy pathways for citizenship for investors, digital nomad visa's, and one-year residential certificates for remote workers (Schubach, 2021). While the Caribbean has indeed become more attractive and affordable for high net-worth buyers and investors ready to commit to second homes across the Caribbean, the IDB (2021) concludes that responding to the existing affordable housing crisis, as well as planning for future residential housing needs are the crux of the Caribbean housing policy challenge toward strengthening inclusive development.

2.2. What is affordable housing?

In general, affordable housing refers to the cost of housing services and shelter - both for renters and owners - relative to a household's income. Housing affordability describes the relationship between expenditure on housing costs (e.g., price, mortgage payments or rents) and household incomes. According to the Stone (2006), affordable housing is an expression of the social and material experiences of people, constituted as households, in relation to their housing situations. In a seminal publication, Howenstine (1983) defined housing affordability as "the ability of the household to acquire decent accommodation by the payment of a reasonable amount of its income on shelter" (Howenstine, 1983). Emphasizing housing expenditures, MacLennan & Williams (1990) state that housing affordability is concerned with a given standard of housing at a cost, which does

not impose an unreasonable burden on household incomes. Thus, what constitutes as affordable is relative to specific housing standards and household income, which may differ according to place and change over time.

The meaning of affordable housing is also influenced by country-specific conditions and national housing policies. For example, in Australia, affordable housing is defined as housing that is reasonably adequate in standard for lower to middle-income households and does not cost so much that a household is unlikely to be able to meet other basic needs on a sustainable basis. Likewise, in India, affordable housing refers to housing that is affordable by that section of society whose income is below or equal to the median household income. Alternatively, in the UK and the USA, affordable housing is defined as housing for which occupants are paying no more than 30 percent of gross income for housing costs, including utilities (Stone, 2006). In the context of Aruban national housing policies, there are no officially established criteria for specifically affordable housing. Nonetheless, concerning social housing, the Fundacion Cas pa Comunidad Arubano (FCCA) offers social housing for those with a maximum monthly gross salary of Afl. 3,125. In order to be eligible for a (non-social) commercial rental property, the rent should not exceed 30 percent of gross income.

Over the past decade, several conceptual dimensions and operationalizations of affordable housing have been proposed. In addressing some of the conceptual ambiguities of affordable housing, and elaborating on previous definitions, Gan & Hill (2008) distinguish between:

i. **Income affordability:** the ability and appropriate income level to purchase and own a house;
ii. **Purchase** or **loan affordability:** the ability to borrow funds to purchase a house;
iii. **Repayment** or **mortgage affordability:** the ability to comply with housing finance re-payments.

Whereas loan affordability reflects a households' pre-qualification for house purchase, mortgage affordability describes a household's cost burden of actual homeownership. The latter is generally defined as housing burden (OECD, 2021). In alluding to likely time-interdependencies between income affordability, loan affordability, and mortgage affordability, the UN contends that a house cannot be considered financially accessible (i.e., loan affordability) nor financially adequate (i.e., mortgage affordability), if it's 'out of reach' due to household income levels (UNHabitat, 2020). Likewise, the extent of housing burden partially stems from (a lack of) changes in income levels and income affordability.

Different objective and subjective measurement approaches are discussed in the literature on affordable housing. Building forth on previous measures of housing affordability (Gabriel et al., 2005; Stone, 2006; Gan & Hill, 2008), the OECD (2021) distinguishes between ratio measures and residual measures of affordable housing (see Table 1). Amongst the objective ratio measures, the relationship between, respectively, (i) median house price and (ii) housing expenditures, and median household income are two of the most widely used indicators of affordable housing in housing studies and housing policies (Linneman & Megbolugbe, 1992; Hulchanski, 1995; Bogdon & Can, 1997; Thalmann, 1999; Bunting et al., 2004; Chaplin & Freeman, 1999; Mak et al., 2007; Chiu, 1996; Lau & Li, 2006; Mostafa et al., 2006; Chen et al., 2010; Haffner & Boumeester, 2010; Li, 2014).

Introduced by the World Bank during the 1990s, the house price-to-income ratio (PIR) – also known as the median multiple (Demographia International Housing Affordability (DIHA), 2022) – is an internationally recognized measure of housing affordability. The PIR is covered in Agenda 21 of the United Nations (UN, 2018) and is defined as the ratio between the median house price and the median gross annual household income (i.e., how many years of household income to cover house purchase costs). According to the World Bank (2018), this ratio is the most important measure of housing market performance, indicating not only the degree to which housing is affordable by the population, but also the presence of market distortions.

	Ratio approach	Residual approach
Objective	***Housing affordability:*** Housing price-to-income ratio (PIR): median house price-to-median (gross) household income. ***Housing burden:*** Housing expenditures-to-(disposable) income ratio (EIR): includes, e.g., rent-to-income, mortgage payments-to-income; share of households spending over 40 percent of disposable income on housing costs.	***Housing poverty:*** Residual income measure (RIM): Captures the level or share of income a household has left after paying for housing costs, to assess the extent to which households have sufficient income left for non-housing expenses after paying for housing.
Subjective	Household satisfaction with the availability of affordable housing. Housing as a (perceived) key short-term concern	Household perception of cost of living and non-household costs. Financial wellbeing and financial satisfaction of households.

Table 1. Measuring affordable housing (Source: OECD; Based on Gabriel et al., Stone, Gan & Hill).

The PIR can be used to compare housing affordability over time and geographies[5]. According to DIHA (2022), the PIR is a reliable, easily applicable, and a structural indicator for measuring the health of residential housing markets and facilitates meaningful comparisons of housing affordability. Moreover, the PIR provides a foundation for the consideration of structural housing policy options for restoring and maintaining housing affordability in local markets. The median-income housing affordability is rated in five (5) categories[6], ranging from the most affordable (PIR < 3.0[7]) to severely affordable (PIR > 5.1[8]).

The housing expenditures-to-income ratio (EIR) describes the relationship between, respectively, housing costs (mortgage payments or rent) and household expenditures (including utility costs), and household income. However, the EIR is more appropriately defined as the cost burden of housing, rather than (income) affordability of housing as it provides a measure of (relative) housing burden. The EIR is readily recognized in the international affordable housing standards, i.e., paying no more than 30 percent of income for covering household expenses. However, the EIR is oftentimes criticized for its rigid (normative) uniformity (Herbert et al., 2018), and questions have been raised about its validity across housing markets and household income levels (see Box 2).

Box 2. Housing burden in Aruba 2006-2016 (Source: CBS, SDG-IWG Aruba).

The unequal burden of housing.
According to the Household Income & Expenditure Survey (HIES, CBS, 2019), the 2016 median gross monthly (two-earner) household income was an estimated Afl. 5,337, up by 1.6 percent when compared to 2006. Housing expenditures totaled Afl. 1,904 and Afl. 1,933 in, respectively, 2006 and 2016. In 2016, the average EIR for all households stood at 36 percent, slightly above the standard EIR threshold of 30 percent. However, when distinguishing between low- and high-income households, a more discerning picture emerges, as the EIR for low-income households is significantly higher (44.5 percent) in comparison to high-income households (28.7 percent). Moreover, between 2006 and 2016, the housing burden more than doubled for low-income households, largely stemming from a surge in total housing expenditures. For high-income households, the EIR edged up by an estimated 13.6 percentage points (from 15.1 percent to 28.7 percent) and remained slightly below the 30 percent EIR standard.

[5] A higher PIR generally reflects relatively less affordable housing (in a specific region at a given time).
[6] As a rule of thumb, the cost of a house should equal roughly 2.6 years to 3.0 years of gross household income (World Bank, 2019; DIHA, 2022).
[7] A PIR below 2.0 may indicate depressed economic conditions (DIHA, 2022).
[8] The World Bank (2018) considers a PIR of more than 4.5 as seriously unaffordable. From a macroprudential perspective, a PIR of 5.0 largely coincides with a (residential mortgage) Loan-to-Income (LTI) ratio of 4.0 (ECB, 2020).

	Low-income households	% change 2016-2006	High-income households	% change 2016-2006	Income inequality (30:30 Palma ratio [9])
Median income (Afl., 2006)	*3,208*		*7,400*		*2.3*
Median income (Afl., 2016)	*3,300*	*2.9*	*8,314*	*12.2*	*2.5*
Total housing expenditures (Afl., 2006)	*709*		*1,115*		
Total housing expenditures (Afl., 2016)	*1,484*	*109.3*	*2,384*	*95.9*	
EIR (2006)	*22.1*		*15.1*		
EIR (2016)	*44.5*		*28.7*		

These results confirm previous studies that the extent of housing burden and housing-induced poverty is relative to household income levels. In general, low-income households experience a comparatively higher housing burden. Whereas low-income households enjoyed a 2.9 percent uptick in income, high-income households underwent a 12.2 percent income growth between 2006 and 2016. Moreover, the importance of differences in household income levels is underscored by the observed income inequality (as measured by the Palma ratio), as well as the increase in income inequality (by 0.2 index point) between 2006 and 2016. According to recent reports (SDG-IWG Aruba, 2021), an estimated 21 percent of the population lives below 60 percent of the median income, of which the elderly (+65 years) are most affected (26.8 percent).

The residual income measure emphasizes an opportunity-cost based definition of housing affordability (Kutty, 2005; Stone, 2006). To assess the extent to which households have sufficient income left for non-housing expenses, the residual income measure (RIM) captures the level of income a household has left after paying for housing costs. Thus, a household is viewed as having a housing affordability problem, if it cannot meet its non-housing demands at some basic level of adequacy after paying for shelter (Stone, 2006). The RIM recognizes housing spending as unique in being the largest and least flexible expenditure in the household budget (Herbert et al., 2018). A household that does not have enough to pay for basic necessities after paying for housing is considered to be suffering from housing poverty, i.e., poverty resulting from a (relatively) high level of housing expenditures (Thalmann, 1999; 2003; Kutty, 2005; Stone, 2006; Herbert et al., 2018).

[9] *The 30:30 Palma ratio measures the ratio of the top-30 percent to the bottom-30 percent of income levels.*

2.3. What are the antecedents of affordable housing?

The dynamics of affordable housing are reflected by the relative measurement of house price and household income, both of which are subject to housing demand and supply factors and (exogenous) shocks. On the housing demand side, affordability primarily depends on household income and the access to finance (i.e., mortgage rates and mortgage loans). On the supply side, affordability is influenced by factors such as, e.g., the costs of housing construction, the price of (available) residential land, the supply of (new) residential properties, as well as the (enforcement of) local land-use regulation and national housing policy controls.

There is an extensive body of research on the determinants of house prices and the antecedents of affordable housing (Geng, 2018; Li, 2014). Studies on affordable housing are generally clustered according to three different themes, although there is significant overlap between studies on:

I. the market fundamentals of house prices (HOPI);
II. the impact of foreign residential real estate investments (FREI), and more recently;
III. the proliferation of the vacation home rental (VHR) market and short-term tourism rentals (STR).

2.3.1. Market fundamentals of house prices

Concerning house price fundamentals, the empirical literature shows that – over the long-run – house prices depend positively on disposable income, demographic developments, credit conditions, and negatively on interest rates and the (supply of new) housing stock (Algieri, 2013; Andrews et al., 2011; BIS, 2020; Capozza et al., 2002; Cohen et al., 2017; Égert & Mihaljek, 2007; Geis & Luca, 2021; Geng, 2018; Girouard et al., 2006; Kallergis, et al., 2018; IMF, 2021). From a demand perspective, it is readily acknowledged that an increase in real GDP per capita and the accumulation of financial net wealth by households exert upward pressure on housing demand and contribute significantly to house price appreciations (Claussen, 2013). However, the IMF (2021) cautions that economic growth may challenge housing affordability if household income does not grow in line with house prices and/or housing costs. From this perspective, a waning housing affordability is a manifestation of growing income inequality across households, resulting from unevenly distributed gains from economic growth, and not necessarily stemming from house market frictions (Couture at al., 2019).

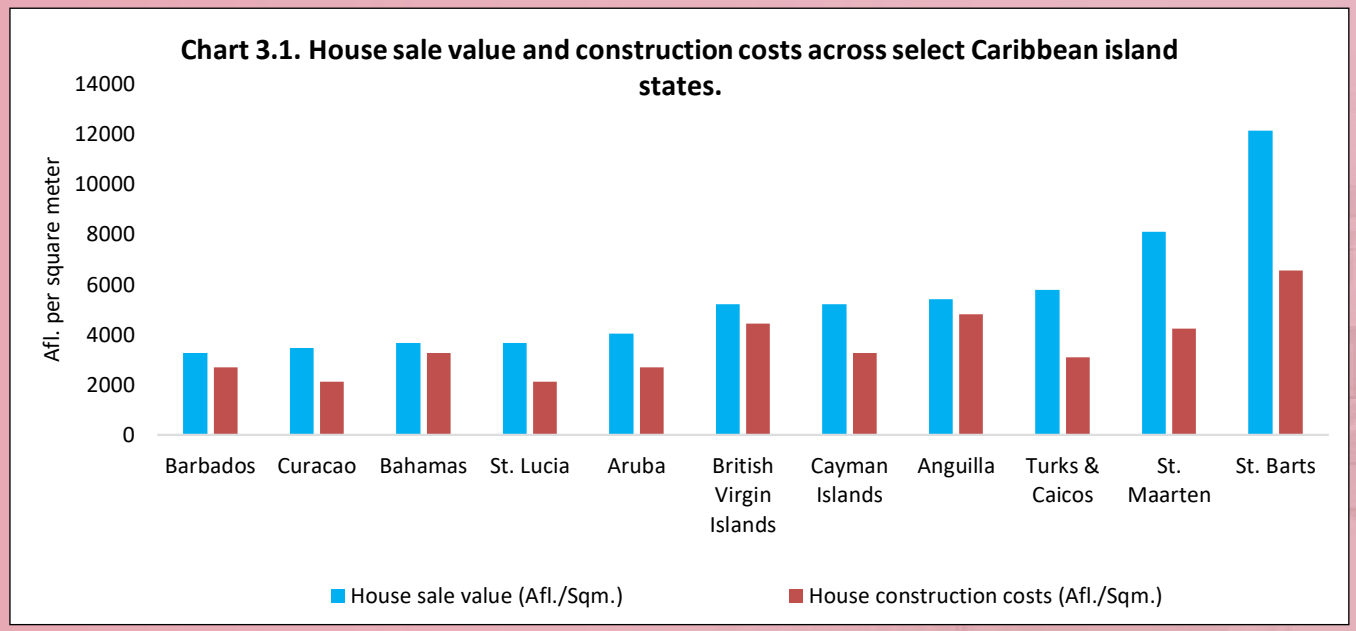
In addition to economic growth, demographic developments and credit conditions affect house price dynamics as well. Population growth and increasing rates of urbanization are positively associated with a rise in house prices (Anundsen et al., 2016; IMF, 2021). Likewise, housing demand is significantly influenced by housing mortgage rates (Bourassa et al., 2013; Turk, 2015; Xu & Tang, 2014). Notwithstanding the positive effect on economic activities, lower house mortgage rates exert upward pressures on house prices (IMF, 2021). From a housing supply perspective, the lack (or lag) of residential construction, in addition to rising construction costs (see Box 3), contribute to housing price gains outpacing income levels, thus, exacerbating the housing affordability problematique (Anundsen et al., 2016; Caldera Sanchez & Johansson, 2011; IMF, 2021).

Box 2. Housing burden in Aruba 2006-2016 (Source: CBS, SDG-IWG Aruba).

The price of paradise.

Across the Caribbean, construction costs and house sale values have increased structurally over the past decade to well over 5 percent annual growth between 2011 and 2021. The surge in residential construction costs is especially pronounced after 2016.

Market studies show that "the most significant increases occurred in the Cayman Islands, St. Lucia, and St. Maarten. The ongoing construction booms in Cayman and St. Lucia explain the increases in those jurisdictions, whereas the increase in St. Maarten is still largely a result of the amount of ongoing reconstruction in the aftermath of Hurricane's Irma and Maria…" (BCQS, p. 7).



2.3.2. The impact of foreign residential and tourism real estate investments

Over and above the (domestic) fundamentals of house price dynamics, previous studies discuss the role of economic openness and the impact of foreign direct investments on house prices. More specifically, there is a growing body of research on the effect of foreign residential real estate investments (FREI) and tourism real estate investments (TREI)[10] on house price appreciation and housing affordability (BIS, 2020; Gascon, 2018; IMF, 2021; Mikulic et al., 2021; Peric et al, 2022). This strand of research is particularly relevant in small open economies that depend heavily on tourism service exports, i.e., small island tourism economies.

Previous studies indicate that TREI has a significant impact on residential house price appreciation (BIS, 2020; Cordero and Paus, 2008; Mihaljek, 2005; Ben-Yehoshua, 2008; Gholipour, 2012; Sá, 2016; Gascon, 2018; IMF, 2021; Mikulic et al., 2021; Peric et al, 2022; Poon, 2017; Wong et al., 2017; Garcia, 2022; Lee, 2021; Merante & Horn, 2016; Nieuwland & Van Melik, 2018; Zou, 2019). Van Noorloos (2012) discusses the rise in residential tourism and TREI to developing countries over the past decade and reflects on the impact in Costa Rica. She concludes that although there may exist some localized and short-run benefits to residential tourism and TREI, in the long run, these selective advantages compromise inclusive and sustainable development by displacing people from their land, in addition to triggering land price inflation (Van Noorloos, 2012). In studying the case of Iceland, Zhang & Yang (2020) find that house prices increase when confronting a positive inbound tourism demand shock. Their findings confirm that higher inbound tourism demand raises the consumption of tourism goods, as well as complementary accommodation, which pushes up more real estate purchase, driving up house prices as a result. Furthermore, more vacation rental properties crowd out the supply in the domestic (residential) housing market, thereby further propelling house prices (Zhang & Yang, 2020).

Research on FREI is generally couched in a longstanding tradition of policies and studies on the contribution of FREI to economic growth (Cordero & Paus, 2008). Consistent with previous studies (Van Noorloos, 2012; Zhang & Yang, 2020), the IMF (2021) reports that FREI may have a disproportionate or lopsided impact on house price appreciation vis-à-vis a rise in income levels or certain household income segments[11]. Essentially, FREI exerts a stronger upward pressure on house prices relative to (median) income levels in the long run (IMF, 2021). Moreover, the situation is aggravated when the FREI growth rate outpaces real GDP per capita growth. This 'double-edged' effect of FREI is well documented in the literature (Couto, 2018; Herzer & Nunnenkamp, 2011), especially in studies in Latin America and the Caribbean (Choi, 2006; Suanes, 2016). The case in point is well captured in a recent study on 'Shock-Responsive Social Protection in Aruba' by the World Bank (Costella et al., 2021):

[10] In general, tourism real estate encompasses properties that are developed to serve tourists (Keller, 1995). Over the past decade, the practice of tourism real estate through digital platforms has been popularized through vacation home rentals, short-term rentals, and the so-called 'Airbnbization' of residential areas (see Section 2.3.III).

[11] Although beyond the scope of this study, previous studies confirm that FDI and income inequality are positively correlated, i.e., FDI contributes to income inequality by disproportionately profiting high-income groups (Huang et al., 2020). In the long run, this may lead to increased levels of relative poverty and non-inclusive economic development.

"While Aruba does not have a poverty line, when using OECD's line of 60% or median income and data of the 2016 Census, one out of every five households (20.7%) in Aruba was deemed poor (DSZ, 2017). The country also has a high level of inequality, with a Gini coefficient of 0.44 in 2016, which is amongst some of the highest in the region, and increasing wage inequality (DSZ, 2017). It appears that the distribution of the national wealth between social groups has not improved on par with economic growth since the 1990s as measured by GDP" (DSZ, 2017, p. 16). "The economy tends to revolve around low wages. Particularly vulnerable groups appear to be youth due to significant unemployment and the elderly, who have limited income." (Costella et al., 2021).

In general, research concludes that structural house price appreciation and, subsequently, unaffordable housing are amplified by FREI buildup. Several (international) empirical studies have been conducted on the impacts and implications of FREI on domestic investments, housing demand (price surges), and housing supply (property scarcity) (Cordero and Paus, 2008; Mihaljek, 2005; Ben-Yehoshua, 2008; Gholipour, 2012; Sá, 2016). Sá (2016) conducted a study on the effect of foreign investors on local markets in England and Wales. She finds that FREI has a significant positive effect on house price growth in the last 15 years. More importantly, the effect was not limited to expensive homes, but 'trickles down' to less expensive properties (Sá, 2016). The adverse effect is stronger where housing supply is less elastic, i.e., limited housing supply or scarce properties act as an amplification mechanism. These findings corroborate research by Gholipour (2012) who concludes that most emerging economies experienced large FREI and a significant appreciation of house prices between 2000 and 2010. In concordance, according to a recent Wharton study, demand for homes from foreign investors pushes up home prices, thereby exacerbating concerns over housing affordability in the USA (Gorback & Keys, 2020). They report that a 1 percent increase in foreign capital raises house prices by 0.27 percent.

The Bank for International Settlements (BIS) highlights the intensifying and expanding footprint of FREI in domestic property price dynamics across several countries (BIS, 2020). According to BIS (2020), residential property prices have reached record highs in several jurisdictions, including Australia, Canada, Hong Kong, Singapore, and Spain. Based on an extensive international study of residential property prices, the BIS (2020) concludes that:

i. *House prices are boosted by higher disposable income and population growth, and by lower interest rates, as well as by elevated foreign capital inflows;*
ii. *The footprint of foreign investors in local residential real estate markets has surged in recent years in a number of jurisdictions, and has had a structural impact on residential property price dynamics, which may result in heightened financial stability risks;*
iii. *FREI is partly driven by the willingness and ability of foreign investments to pay a higher price compared to domestic investors and may crowd-out the domestic market. For relatively larger residential properties, international investors pay 10 percent more than local investors;*
iv. *As future valuations tend to be anchored by previous transaction prices, the greater willingness to pay by foreign investors – in addition to specialized real estate services catering to foreign markets – significantly raises residential property prices;*
v. *FREI may have a compounding effect on the market fundamentals (e.g., income, population growth, and credit conditions) of house price appreciation, hence resulting in significant housing affordability stress in domestic markets.*

Box 4. Affordable housing in St. Maarten (Source: World Bank).

Housing sector assessment of St. Maarten
According to the Rapid Housing Sector Assessment of St. Maarten by the World Bank (WB, 2020), the housing market faces several serious challenges, including the lack of housing affordability, severely constrained land markets, poor condition of the existing housing stock, and increasing vulnerability of certain social groups.

The WB observes that St. Maarten has a bifurcated housing market that is structured around two distinct demand-supply chains, i.e., (i) one that caters to the foreign (wealthy) investors buying luxury real estate, and (ii) another that caters to the low- and middle-income local population (largely living in modest or substandard rental housing and informal housing). The former is the primary target group for much of the formal construction industry, whereas the latter constitutes modest, self-built, incrementally constructed houses. This duality is quite typical of housing markets in tourism-based economies on small islands, according to the WB.

In terms of house prices, the WB states that the price point of the cheapest houses for sale in the market are US$ 200,000-250,000 (for a standard house of 2-3BR, 2-bath, 120-150 m2). Even if financing is available, there is little in the formal market for purchase or rent that is affordable to people below the 60th income percentile (monthly household income less than US$ 3,000). For most households earning less than the median monthly household income of USD 2,000, formal housing options are even more scarce.

The WB concludes that "for the majority of households earning less than Sint Maarten's median household income of approximately USD 2,000 per month, options to purchase a house in the market are scarce to non-existent" (WB, p. 71).

Empirical studies have also examined the drivers of FREI. Poon (2017) focuses on the key factors affecting FREI in London (UK) and finds that GDP growth and international tourism demand have a positive impact on FREI, while land price and interest rates have negative impacts. Likewise, Gholipour & Masron (2011) and Wong et al. (2017) find that international tourism demand and tourism specialization are significant determinants of FREI. Furthermore, Rangel & Ng (2017) indicate that foreign real estate investors tend to invest aggressively in markets where the real exchange rate is relatively favorable. Asal (2019) reports that an important determinant of housing demand and prices is the real exchange rate. According to Asal (2019), in standard small open economy models in which foreign investment plays an important role, real exchange rate depreciation (i.e., an improvement in international competitiveness) has an expansionary effect on aggregate demand and drives up housing prices. Similar to Benson et al. (1999), Rangel & Ng (2017) and Asal (2019) conclude that a weakening domestic real exchange rate leads to a rise in house prices.

Foreign demand shocks may spill-over into domestic housing markets. In focusing on the specific role of exogenous shocks, Badarinza & Ramadorai (2016) investigate whether (a surge in inflow of) foreign capital is responsible for residential real estate price movements in global cities, especially during (foreign) economic crises. They find that foreign risk and (non-

domestic) economic shocks strongly affect domestic house prices and that the effects are long-lasting. Ari et al. (2020) conclude that there is a significant effect of foreign demand shocks on local house prices over the last 20 years, especially in regions (in the USA) that were already unaffordable for the median-income household.

Box 5. Affordable housing in the European Union (Source: EU).

The Urban Agenda.
Access to affordable housing is the focus of one of the partnerships in the Urban Agenda in the EU. The initiative stems from the acknowledgement from member states that while foreign investors have long been operating on real estate markets, in recent years, urban property has increasingly become the commodity of choice. According to the EU, when foreign investors own rented homes (or mortgages), money mainly flows out of communities. Oftentimes, many corporate owners of housing are anonymous or not registered, thereby obscuring where and to whom exactly ownership belongs, in addition to foregone real estate tax revenues. The EU expressed serious concerns about the adverse impacts on housing affordability.

In 2015, the Housing Partnership was one of the first partnerships to be established within the framework of the Urban Agenda for the EU. This partnership was given a three-year mandate to work on public and affordable housing, state-aid rules, and general housing policy.
In resolving these complex housing challenges, their relevance for the EU and its citizens was acknowledged, even though the EU does not have a direct mandate on housing. While considering all governmental levels, the partnership specifically focused on cities.

In December 2018, the final action plan was presented, identifying 12 key actions, including: better guidance on EU regulation and public support for housing; capacity building for the application of state-aid rules in the affordable housing sector on city level; the establishment of an affordable housing good practices database; recommendations on improving the EU urban housing market data; and recommendations on the improvement of EU gender-poverty-energy nexus data.

2.3.3. The platform economy: The rise of vacation home rentals

Rogers & Koh (2017) discuss the globalization of real estate, especially in light of the platform economy and the rise of shared services, including transportation (e.g., Uber) and housing (e.g., Airbnb). They contend that the rise in foreign (tourism) investments in residential real estate – especially by a 'new' middle-class and wealthy investors – has emerged as a key political issue in academic and public debates (Rogers & Koh, 2017). Indeed, previous studies show that governments across, e.g., Australia, Canada, Hong Kong, Singapore, and Switzerland are grappling with a host of geopolitical questions and social challenges, including the need to protect the local housing market and safeguard affordable housing for residents. The adverse effect of the continued FREI buildup is also corroborated by Mihaljek (2005) in his study in Croatia, and Kim's (2019) research in Korea. Similar concerns are shared in the Dutch Caribbean (BES reporter, 2022:

"In recent years, the house and rental prices have gone up considerably in Bonaire. The Executive Council is concerned about this development. This is the reason why it is taking various measures, which will make more affordable rental housing available to residents. Renting out homes for short-term stays often yields more money than renting them out long- term. Consequently, it is becoming increasingly difficult for residents to rent a home, as fewer houses are available, and the rents are higher. Preventing short-term rentals of homes to tourists is one of the measures that should lower the prices on the housing market. In most neighborhoods, it is not allowed to rent out homes for a short-term stay. It is only permitted in certain areas that are detailed in the Bonaire Spatial and Development Plan." (BES reporter, 2022).

Box 6. Brief history of the Vacation Home Rental Market (Source: RentalsUnited.com, VRMintel.com, grandviewresearch.com/industry-analysis/vacation-rental-market)

Origins of the Vacation Home Rental (VHR) market.
The first online platform to enable vacation home and short-term rental bookings was VRBO (Vacation Rentals by Owner) in 1995. VRBO allowed users to directly book vacation rental properties that were managed by their individual owners. In 1996, Booking.com was founded in the Netherlands. Although a travel fare aggregator of hotels and lodging options, Booking.com was one of the first hotel booking sites to advertise vacation home rentals. Around the same time as VRBO and Booking.com were being created, Craigslist turned from a simple mailing list into a website for people to list ads and request services online. The website provided a more informal platform where advertisements for short-term and long-term rentals were posted.

A growing VHR industry.
The mid-2000s saw two main home rental innovations. Firstly, the launch of HomeAway, a merger of five different rental sites, which later acquired VRBO in 2006. More impactfully, Airbnb stepped up to the stage as a small San Francisco startup in 2008. While the previous companies offered various forms of vacation rentals and hotel bookings for short stays, Airbnb was the first company to allow guests to book a single room in a host's home and pay using a credit card over the internet. The company also expanding outside of the short-term rental space with 'Airbnb Experiences', which allows users to host unique city tours, events, and classes that anyone can sign up for through the Airbnb website. Today, international hotel chains like Marriott International are expanding their services to the home rental space by offering thousands of upscale homes for short rental to the market.

Global expansion.
Globally, the VHR market has expanded markedly over the past decade. Market studies show that the global VHR market size – including homes, condominiums, villas, and apartments – was valued at US$ 74.6 billion in 2021. It is expected to expand at a compound annual growth rate of 5.3 percent from 2022 to 2030. Rising expenditures on travel, vacations, and accommodations among the millennials generation, as well as among the more affluent (high-income) travelers are largely driving the market frenzy.

Research shows that the unregulated expansion of vacation home rentals (VHRs) exacerbates the affordable housing crisis by simultaneously distorting housing supply (i.e., less available residential housing), as well as housing demand

(i.e., house value appreciation) (Garcia, 2022; IMF, 2021; Lee, 2021; Merante & Horn, 2016; Nieuwland & Van Melik, 2018; Zou, 2019). In essence, the confluence of affluent tourism (high-income families and net-worth individuals) acquiring second or vacation homes displace and distort the domestic housing market, thereby adversely affecting housing affordability, especially for low- to middle-income households. In response to the uncontrolled surge in the VHR market, several cities have recently introduced VHR regulations and expanded STR regulations (see Table 2).

City, Country	Synopsis of VHR and STR regulations
Amsterdam, The Netherlands	According to new Tourist Rental of Housing Act, vacation rentals need to be officially registered and a business license to operate. A VHR zoning license is also required to operate. Revenue earnings as a Host are subject to rental tax, income tax, and VAT. Currently, Airbnb collects and remits tourism tax on behalf of hosts in Amsterdam. Hosts cannot rent out a property for more than 30 nights to a maximum of 4 guests. The city of Amsterdam can request Airbnb to block the calendar for the rest of the year of entire home listings that have reached the statutory night limit of 30 nights.
Barcelona, Spain	Property owners must have a city-approved license to rent their property on Airbnb.
Paris, France	Listings must have a registration number to ensure compliance, and apartments may only be rented out for 120 days a year.
Las Vegas, Nevada, USA	Primary residents must have a permit and must remain present during any short-term stay. Hosts cannot rent out a property for more than 31 days.
Los Angeles, California, USA	Hosts may only rent out their primary residences (where they live for more than 6 months out of the year). Furthermore, Hosts may rent no more than 120 days per year.
San Francisco, California, USA	Hosts must be permanent residents and live on the property for a minimum 275 nights per year. They may not have more than one listing or rent out for more than 90 nights each year. They must also register for a business license and pay 14 percent of their (rental) income revenue to the City tax authorities.
New York City, New York, USA	Hosts renting for less than 30 days must be permanent residents. While Hosting, they must occupy the property, and they may not Host more than one property at a time.

Table 2. Vacation Home Rentals (VHR) and Short-Term Rental (STR) regulations (Source: Airbnb statistics).

The adverse impact of uncontrolled VHR markets is particularly acute when income generated from the VHR market seeps out the local economy or is highly concentrated. With regard to the latter, the IMF (2021) reports that when VHR revenue income is mainly concentrated in certain household segments or at 'wealthy strata', shared community benefits do not accrue, but rather fuel income inequality and social exclusion (IMF, 2021). Based on a joint study by the National Bureau of Economic Research (NBER), the University of California, Los Angeles (UCLA), and the University of Southern California (USC), Barron et al. (2017) conclude that a 10 percent increase in VHR listings leads to a .76 percent increase in house prices. Furthermore:

"…given that the short-term rental industry has grown by 800 percent since 2011, it is therefore not hard to see why many people are concerned about this industry's impact on the affordability of housing for residents. If a 10 percent increase in the number of short-term rental listings was found to lead to a .76 percent increase in house prices, the actual 800 percent increase would be responsible for a 60 percent increase [in house prices] over that same time period. For comparison, the median household income in the U.S. grew only 18.0 percent since 2011." (Barron et al., 2017).

The IMF (2021) reports that short-term rental schemes increase the competition for available house properties and drive-up house prices, thereby intensifying housing affordability problems for existing residents. These findings are corroborated by Garcia-López et al. (2019) who find that in neighborhoods with average Airbnb activity, house prices have increased by 5.3 percent with the effect being considerably higher (+14 percent) in neighborhoods with more Airbnb activity. Barron et al. (2020) report that a 1 percent increase in Airbnb listings increases house prices by 0.26 percent. Similar to Van Noorloos (2012), Bivens (2019) finds that the costs of Airbnb expansions to local jurisdictions exceed the benefits to VHR visitors and VHR property owners. Alternatively, Koster et al. (2018) shows that regulating Airbnb decreases house prices by 5 percent. These conclusions are consistent with multiple international studies on the profound adverse impact of uncontrolled VHR market expansion on house price appreciation and, consequently, on – the erosion of – affordable housing, as well as the financial exclusion and social marginalization of low- to middle-income households (Bernardi, 2018; Calder-Wang, 2019; Cocola-Gant, 2016; Haar, 2018; Lee, 2016; Merante & Horn, 2016; Roelofson, 2018).

Box 7. Affordable housing in the EU (Source: European Parliament)

Ensuring access to affordable housing.
In a recent study on the current situation and key challenges with regard to housing affordability in the EU, as well as policies to ensure access to affordable housing at national and EU levels, the European Parliament concludes:

"One of the key factors behind rising housing costs and the decreasing affordability of housing in Europe is the so-called 'financialization' of housing, which is generally defined as the transformation of housing into a financial asset or commodity. The integration with and increasing dependence of housing on the general financial market, especially the financial market for mortgages, have been one of the key factors linked to the financialization of housing in the EU. Evidence also shows that foreign investment increases local house prices and reduces the rate of home ownership in the area,

especially in places where housing stock reacts more slowly to housing price changes." (EU, p. 8)

"Another recent trend that affects housing prices and access to affordable housing in the EU is the rise of collaborative economy platforms for short-term accommodation (Airbnb, HomeAway etc.). According to the most recent data from Eurostat, in the EU-27 countries, the percentage of individuals who used dedicated websites or apps to arrange accommodation from another individual increased from 12% in 2017 to 17% in 2019. While this average increase was reflected in nearly all European countries, in some the rise was particularly steep – e.g., Ireland (from 17% in 2017 to 31% in 2019), Luxembourg (from 18% to 37%) or France (from 17% to 23%). As of March 2020, out of the five countries in the world with the most Airbnb listings, four were European countries: France (in second place with 485,000 listings); Italy (third, with 340,000 listings); Spain (fourth, with 245,000 listings); and the United Kingdom (fifth, with 175,000 listings).

A recent mapping of Airbnb in European cities showed that the number of Airbnb offers is positively related to the size of the city and its importance as a leisure tourism destination. In addition, the study showed that in major tourist destinations, particularly in the coastal and historic cities of the Mediterranean countries, Airbnb offers more second homes and apartments exclusively used for tourist purposes. Hence the platform not only creates a new form of accommodation, but also enables the commercialization of private second homes, and serves as a new distribution channel for existing commercial accommodation. Finally, the evidence shows that the majority of Airbnb listings in most cities are entire homes, many of which are rented out all year round.

Recently, there has been an increase in literature and research exploring the potential negative impacts on European cities of short-term rentals. These include:

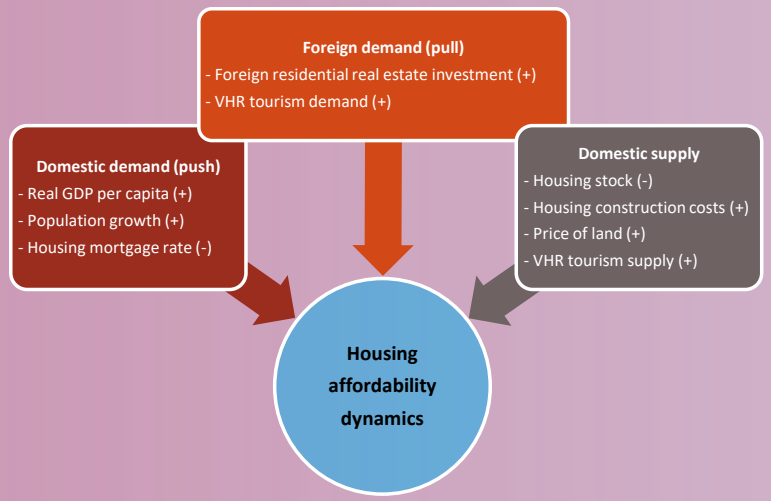
- ***Negative impact on housing affordability for the local population.*** *According to critics of these platforms, they restrict the availability of affordable housing to locals, and help to push up rental prices, thereby displacing local communities. A study by the Economic Policy Institute has concluded that the costs of Airbnb expansion exceed the benefits to travelers and property owners. The largest cost of Airbnb expansion is the reduced supply of housing, as properties shift from serving local residents to serving Airbnb travelers, which hurts local residents by raising housing costs. Similarly, a study in Barcelona has shown that the estimated impact in neighborhoods with high Airbnb activity is substantial. For neighborhoods in the top decile of the distribution of Airbnb activity, house rents are estimated to have risen by 7%, while increases in house transaction prices are estimated at 19% (14%).*

- ***Gentrification of European cities.*** *Since the number of long-term rentals on offer to local population is reduced and the price of housing expanded, the areas most affected by short-term rental platforms encourage the relocation of residents to another district and, thus, encourage the processes of gentrification and segregation. Those who dwell in such areas struggle to find long-term rentals or affordable housing solutions, and are in addition confronted with significant increases in the cost of services, due to the growing presence of tourists that leads business owners to raise prices." (EU, p. 25-26).*

2.3.4. Conceptual framework

In review of previous studies and the cumulative findings on the determinants of affordable housing dynamics, three basic (push-pull) factors are distinguished that shape housing affordability dynamics (see Figure 5). From a ***demand perspective***, there are two essential factors that describe (i) domestic (push) developments, including real economic growth, population growth, and (lower) housing mortgage rates, in addition to (ii) (pull) developments in expanding foreign residential real estate investments and VHR tourism demand.

From a ***supply perspective***, the construction of new housing units and the total stock of house units shape the dynamics of affordable housing by counterbalancing upward demand pressures for housing. Alternatively, increases in housing construction costs and price of land drive up house prices, whereas VHR tourism supply – the (regional) distribution and concentration of VHR properties – has a commensurate positive impact on house prices.



3. The State of Affordable Housing: Developments and Drivers

Based on the conceptual framework and the subsequent data collection and data analysis, this chapter presents the main findings of this study. As a backdrop, recent housing developments are described in Section 3.1, followed by an analysis of the state of affordable housing (Section 3.2). In Section 3.3, the effect of demand drivers and supply conditions on housing affordability is explored. This section concludes with a discussion on the main determinants of housing affordability (Section 3.4).

3.1. Taking stock of housing and housing developments

In 2020, Aruba counted a total of 38,831 housing units (see Table 3), up from 34,845 in 2010 (+11.4 percent) (CBS, 2021). The majority of housing units (24,014; 61.8 percent of total housing stock) are located in the regions of Noord-Tanki Leendert, Oranjestad (West & East), and Paradera. With the exception of San Nicolas (South), the number of housing units expanded in other regions. Between 2000 and 2010, the largest relative growth in housing units was concentrated in Paradera (42 percent), Noord/Tanki Leendert (36.8 percent), and Savaneta (23.7 percent). However, over the past decade, the expansion in housing units has gravitated towards Santa Cruz (23.7 percent) and Paradera (19.7 percent).

Consistent with population density trends, over the past two (2) decades, the island experienced a significant increase in the housing density, as measured by the number of housing units per km². For 2021, the housing density is estimated at 277 housing units per km², up from 209 housing units per km² in 2000. Considering the need for housing resulting from population growth projections (see Figure 6), housing density is expected to surpass 320 housing units per km² by 2030 (CBS, 2021; ROPV, 2021).

Region	2000	2010	2020	% change 2000-2010	% change 2010-2020
Noord/Tanki Leendert	5,418	7,402	8,603	36.6	16.2
Oranjestad-West	4,208	5,022	5,195	19.3	3.4
Oranjestad-East	4,740	5,106	5,526	7.7	8.2
Paradera	2,760	3,919	4,690	42.0	19.7
Santa Cruz	3,730	4,200	5,194	12.6	23.7
Savaneta	3,164	3,914	4,288	23.7	9.6
San Nicolas-North	3,258	3,469	3,620	6.5	4.4
San Nicolas-South	1,968	1,813	1,715	-7.9	-5.4
Total	**29,246**	**34,845**	**38,831**	19.1	11.4
Registered population	90,506	101,918	107,221	12.6	5.2
Average persons per housing unit	3.1	2.9	2.8		
Housing density (house units/km²)[13]	208.9	248.9	277.4		

Table 3. Total registered housing units[12] by region in 2000, 2010, and 2020 (Source: CENSUS, CBS).

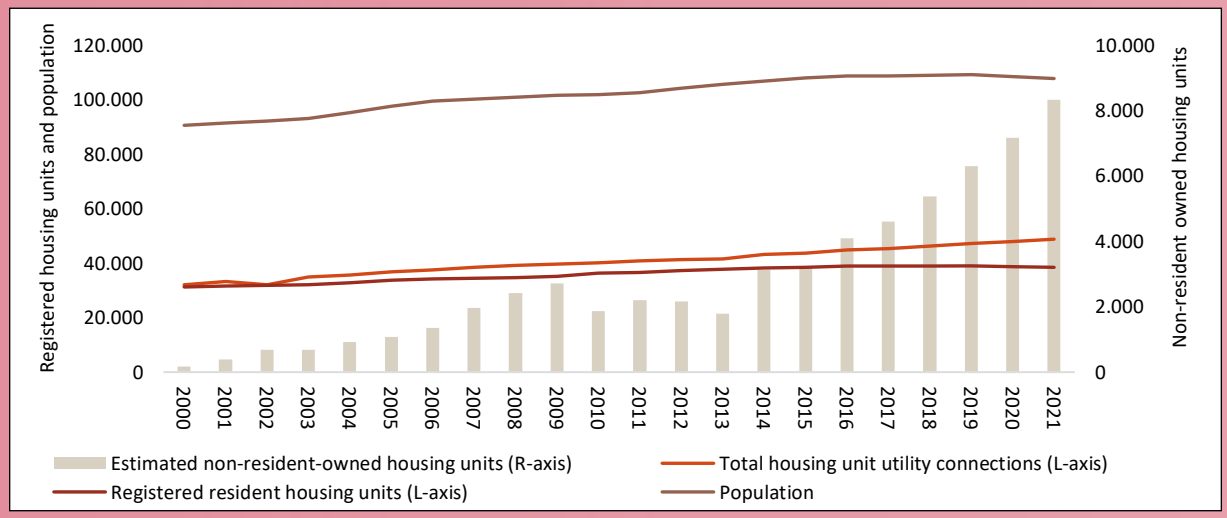
[12] *Including house dwellings and apartments.*

[13] *Housing density estimates take into account national protected environmental areas.*

Box 8. Registered resident housing units and estimated non-registered, non-resident-owned housing units (Source: CBS, WEB).

Growing divergence in registered housing units.
Whereas the increase in registered housing units is largely explained by population growth, data on housing utility connections suggests, however, that there are at least 8,000 housing units unaccounted for based on registered (resident-owned) housing units. This gap between registered housing units and total housing unit utility connections has widened considerably as of 2013.

Although several explanations exist for this discrepancy, the structural growth in divergence is partially explained by (i) the use or substitution of residential properties as vacation homes and other types of long and short-term rental properties, in addition to (ii) the sale of residential homes to non-residents. It is estimated that at least 22 percent of residential recreational homes were owned by non-residents in 2021.



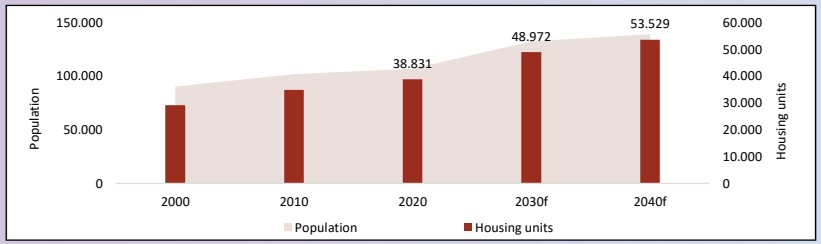
Projected population growth drives future housing demand. Based on the population growth projections and barring any mayor natural disasters, an additional 10,000 housing units would need to be built by 2030 to accommodate the expected need for residential housing (see Figure 6.1). Accounting for house construction price inflation and considering standard and affordable housing (i.e., standard house size of 100 m2 and a PIR < 3.0), as well as the additional costs for energy-efficient housing, the estimated annual investment in new (+600) residential housing construction is conservatively projected at Afl. 175 mln.

The demand for (affordable) social housing has increased over the past decade. Multiple policy reports indicate that the demand for housing is an enduring concern, especially considering the lack – and structural lag – of (new) housing supply (Boekhoudt, 2010; FCCA, 2020, 2021; ROPV, 2021; DIP, 2020). According to the *'ROPV alignment brief based on policy principles: For a sustainable design of Aruba in the context of a sustainable growth model'* [14] (DIP, 2020):

"The Aruban housing market is characterized by a structural housing shortage. Illustrative for this are the long waiting lists and waiting times that apply to a rental property, a property lot with the Fundacion Cas pa Comunidad Arubano (FCCA), or a leasehold plot with the Infrastructure and Planning Department (DIP). Due to the constant population growth as a result of economic growth, the housing shortage remains constantly under expansion pressure." (DIP, 2020; p.13).

Demand pressures for affordable housing are unlikely to recede in the next decade. Based on historical records and annual reports of the Fundacion Cas pa Comunidad Arubano (Boekhoudt, 2010; FCCA, 2020, 2021), analysis shows that official petitions and requests for social housing have increased by at least 145 percent; from 1438 requests (i.e., 6.4 percent of total housing in 2010) to an estimated 3528 requests (i.e., 8.5 percent of total housing in 2020) between 2004 and 2021 (see Figure 6.2). Furthermore, according to the Spatial Development Plan (ROPV, 2021), in addition to social housing demand, the general need for housing is projected at 5,000 housing units (in 2025). Thus, cumulatively, in the medium term, total housing demand is set to reach close to 10,000 housing units and future social housing demand is projected, ceteris paribus, to surpass 10 percent of total housing units by 2030.

1.Population growth and housing demand.



2. Social housing demand: official petitions and registered FCCA requests for social housing.

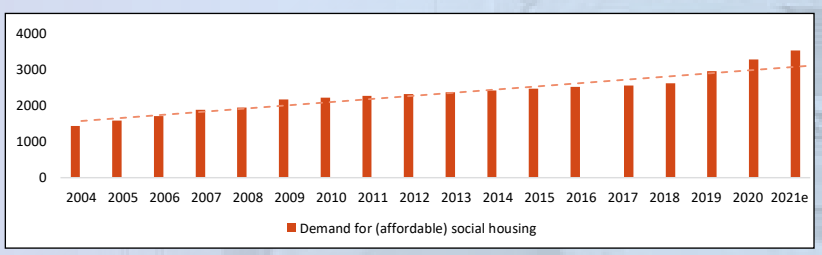


Figure 6. Housing demand: population and housing units estimates and forecasts (Source CBS, FCCA, ROPV; Author's calculations).

[14] *In Dutch: ROPV Afstemmingsnota van beleidsuitgangspunten. Voor een duurzame inrichting van Aruba in het kader van een duurzaam groeimodel (DIP, 2020).*

The majority of the population owns a house. According to the CENSUS 2020 (CBS, 2021), an estimated 78.6 percent of the registered population owns a house, whereas 19.5 percent rents either an apartment or a house (see Table 4). Of the owner-occupant housing units, 45 percent is on leasehold land and 29 percent is on property land. Noord-Tanki Leendert and Oranjestad (W&E) have, proportionally, the largest number of apartments (see Figure 7).

Tenure of household		Houses	Apartments	Other	Total
Owner-occupant	Housing unit on property land	28,246	1,843	879	30,968
	Housing unit on leasehold land	45,272	2,031	979	48,282
	Housing unit on leased land	4,036	563	433	5,032
	Sub-total	*77,554*	*4,437*	*2,291*	*84,282*
Tenant	Rented, furnished	887	1,824	228	2,939
	Rented, semi-furnished	1,040	2,179	177	3,396
	Rented, not furnished	8,235	5,548	528	14,311
	Sublet	150	50	17	217
	Sub-total	*10,312*	*9,601*	*950*	*20,863*
Lived in for free by members of the household		921	739	291	1,951
Total		87,866	14,038	3,241	107,221
As percentage (%)	Owner-occupant	88.3	31.6	70.7	78.6
	Tenant	11.7	68.4	29.3	19.5

Table 4. Population occupying housing units by type of housing unit, tenure of household and, for tenant households, ownership of housing unit (Source: CENSUS, CBS).

Number of houses and apartments across different regions in 2020.

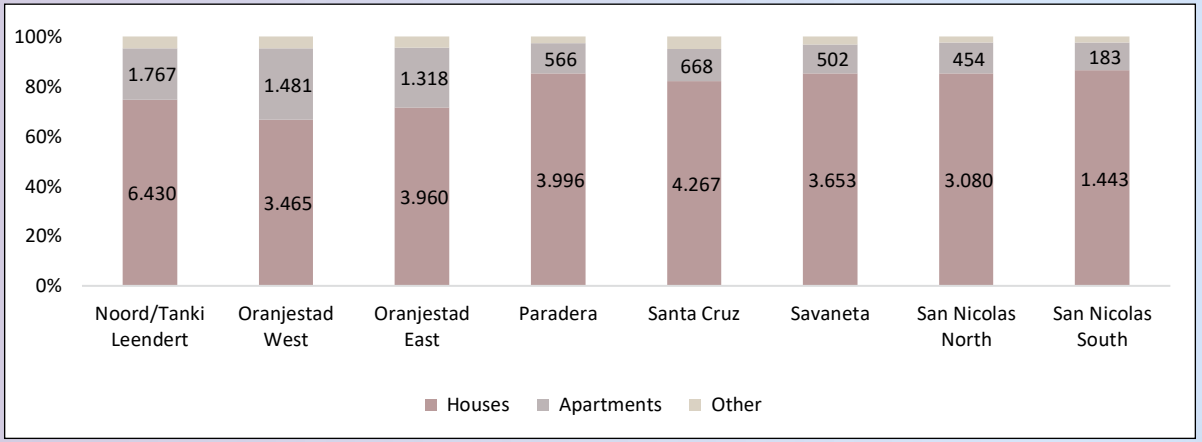


Figure 7. Regional distribution of houses and apartments (Source: CBS).

3.2. The state of affordable housing

Over the past decade, median house prices appreciated by 19.5 percent on average; almost seven (7) times faster than the median household income growth rate (see Table 5). House price surges (14 percent on average) were especially manifest between 2010 and 2015. During this period, the PIR rose from 4.3 to 5.0 (i.e., seriously to severely unaffordable housing), largely due to median household income growing at a comparatively slower rate vis-à-vis median house prices. The median gross household income inched up by 2.8 percent from 2010 and 2021, indicative of sticky wages and stagnant household income levels.

Inelastic housing supply has a compounding adverse effect on housing affordability. Housing demand, as measured by median house price appreciation, rose almost four (4) times faster than the housing supply growth rate over the past decade, thereby corroborating previous studies on the adverse effects of relatively inelastic housing supply (DIP, 2020; ROPV, 2021; Sá, 2016). Controlling for the effect of population growth and inflation, analysis indicates that the increase in the PIR (i.e., a drop in housing affordability) is attributed to concurrently (i) the significant rise in median house prices and (ii) the non-significant change in median gross household income between 2010 and 2021 (see Table 4).

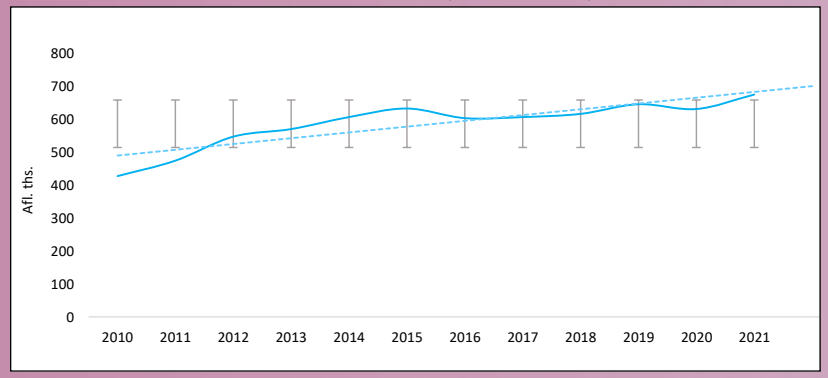
	Indicators	Average 2010-2015	Change (%) 2010-2015	Average 2016-2021	Change (%) 2016-2021	Change (%) 2010-2021	Significant difference (2010-2015 vs. 2016-2021)	Association housing affordability (PIR[15])
Housing affordability	Median house price (Afl.)	555,833	14.0	613,750	4.3	19.5	***	+*
	Median gross household income (Afl.)	126,800	7.8	122,493	-5.2	2.8	NS	-
	Price-to-Income ratio (PIR)	4.3		5.0			**	

Table 4. Housing affordability indicators (2010-2021. Source: Author's calculations).

** p<.05, **p<.01, ***p<.005, NS=non-significant*

The findings show that whereas the COVID-19 pandemic (2020) had a significant impact on the median household income (HINC)[16], the median house price (HOPI) remained relatively stable and returned to its long-run trend estimate in 2021 (see Figure 8.1 and Figure 8.2). Hence, in 2020, the PIR jumped to 6.4, and lingered at an elevated level (5.9) in 2021 (see Figure 9).

1. Median house price (HOPI) trend and standard deviation 2010-2021 (Source: CBA).



2. Median annual household income (HINC) trend and standard deviation 2010-2021 (Source: CBS, WB).

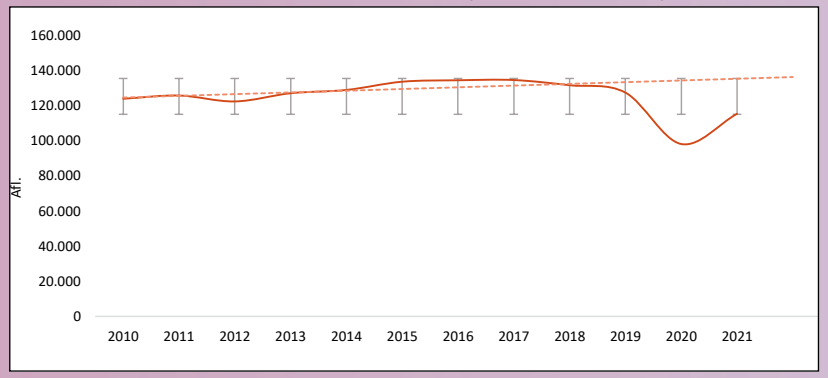


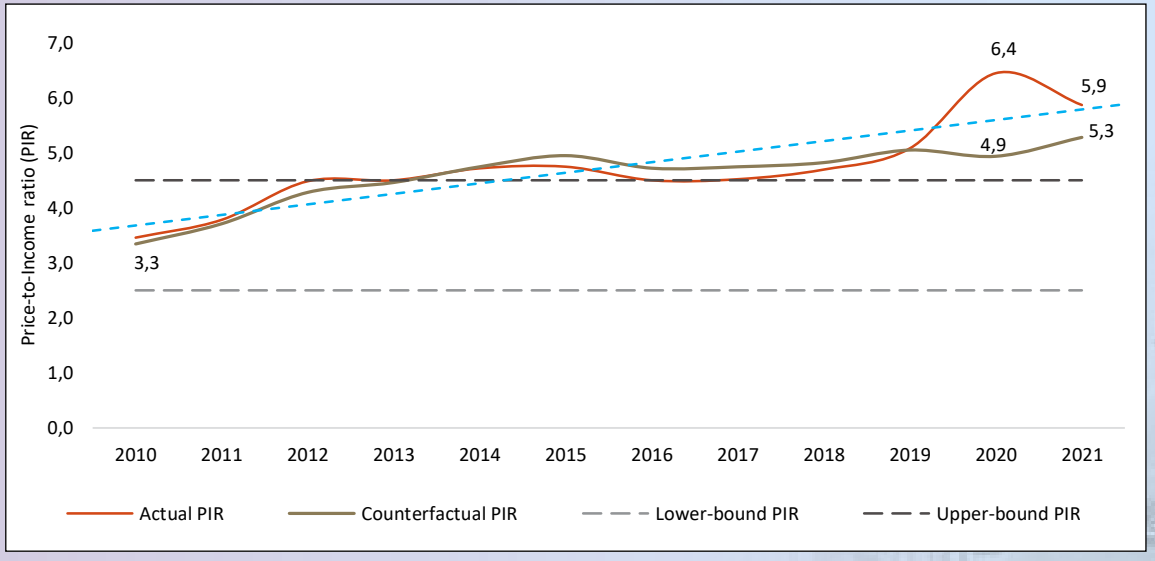
Figure 8. Trend analysis of the median house price (HOPI) and the median household income (HINC) 2010-2021 (Source: Author's calculations).

[15] A positive association (+) denotes an increase in the PIR and describes relatively less affordable housing. The effect is measured by the partial regression controlling for population and inflation.

[16] As measured by a shock impact of more than one standard deviation point.

Trend analysis of housing affordability shows that between 2010 and 2021, the PIR rose from 3.3 to 5.9, i.e., more than double (x2.2) the recommended standard of 2.6 (see Figure 9). Between 2013 and 2019, the PIR remained well above affordable housing standards, spiking to 6.4 in 2020[17]. Counterfactual analysis indicates, however, that absent the COVID-19 pandemic shock, the PIR would have stood at, respectively, an estimated 4.9 and 5.3 in 2020 and 2021; still well above recommended housing affordability levels. Thus, whereas the COVID-19 pandemic and the subsequent household income shock partially explain the housing affordability challenge, other (structural) factors are at play.

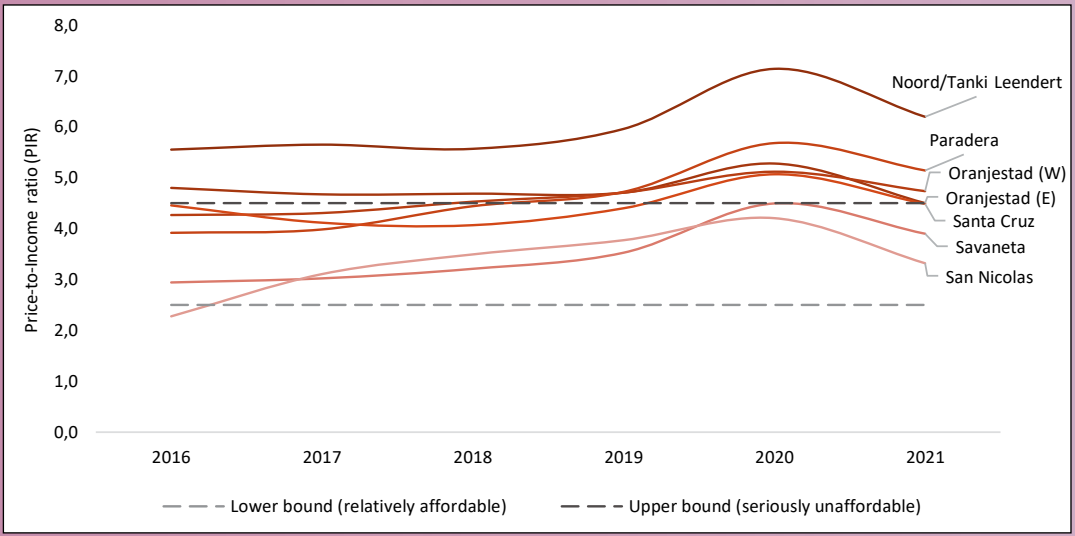
Figure 9. What if there were no COVID-19 pandemic in 2020.



From a regional perspective, the deterioration of housing affordability is especially noticeable in Noord-Tanki Leendert and Paradera, followed by Oranjestad and St. Cruz (see Figure 10). By 2019, Noord-Tanki Leendert, Paradera, and Oranjestad had already surpassed the critical PIR upper bound. In 2021, Savaneta and San Nicolas were still relatively affordable for middle-income households, although upward PIR pressures were clearly active between 2016 and 2019.

[17] *In 2020, non-performing housing mortgage loans rose by 2.2 percentage points (Source: Financial Sector Supervision Report, CBA, 2021).*

Figure 10. Regional housing affordability trends and heat map (Source: Author's calculations).



1. Most and least affordable regions for housing.

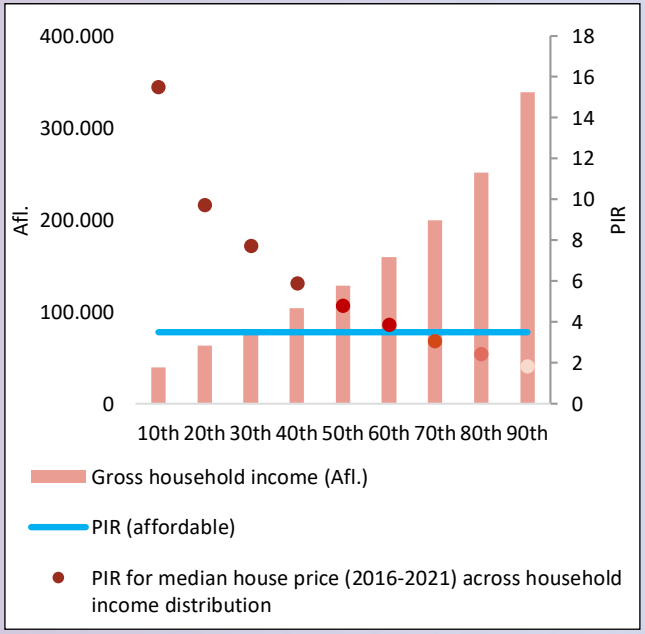
	Noord/Tanki Leendert	Oranjestad (E)	Oranjestad (W)	Paradera	Santa Cruz	Savaneta	San Nicolas
2016	5.6	4.8	4.3	3.9	4.5	2.9	2.3
2017	5.6	4.7	4.3	4.0	4.1	3.0	3.1
2018	5.6	4.7	4.5	4.4	4.1	3.2	3.5
2019	6.0	4.7	4.7	4.7	4.4	3.5	3.8
2020	7.1	5.3	5.1	5.7	5.1	4.5	4.2
2021	6.2	4.5	4.7	5.1	4.5	3.9	3.3

2. Housing affordability heatmap of Aruba.

PIR	
>5.1	*Severely unaffordable*
4.1-5.0	*Seriously unaffordable*
3.1-4.0	*Moderately unaffordable*
2.1-3.0	*Affordable*
<2.0	*Amply affordable*

Relative to the percentile distribution of gross household income levels, the results show that, in general, housing is not affordable for the average Aruban household (See Figure 11.1). Considering current (median) house prices, affordable home ownership remains completely 'out of reach' for low-income households (bottom 30 percent of household income distribution). Hence, the growing number of registered applications for social housing in recent years (FCCA, 2021). Furthermore, housing has become relatively less affordable for middle-income households (50th-60th percentile), as house prices surged, and income levels remained relatively stagnant. For middle-to-high and high-income households (upper 30 percent of household income distribution), however, housing is relatively affordable (i.e., PIR < 3.0). Considering the median house price by region, the required annual median household income for affordable housing ranges between Afl. 164,000 (in Santa Cruz) and Afl. 226,000 (in Noord-Tanki Leendert), well above the current median household income (See Figure 11.2).

1.Housing affordability across gross annual median household income percentiles in 2021.



2.Required gross annual median household income for relatively affordable housing across regions in 2021.

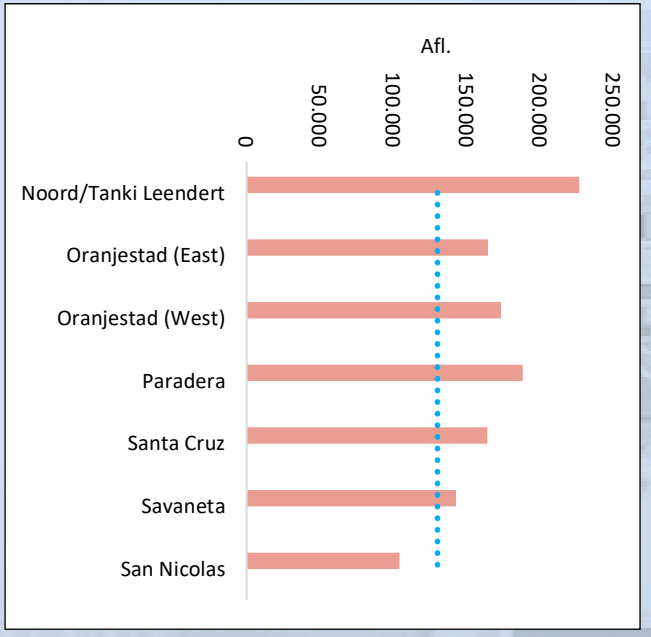


Figure 11. Housing affordability by gross annual median household income and regions (Source: CBS, CBA, WB, Author's calculation).

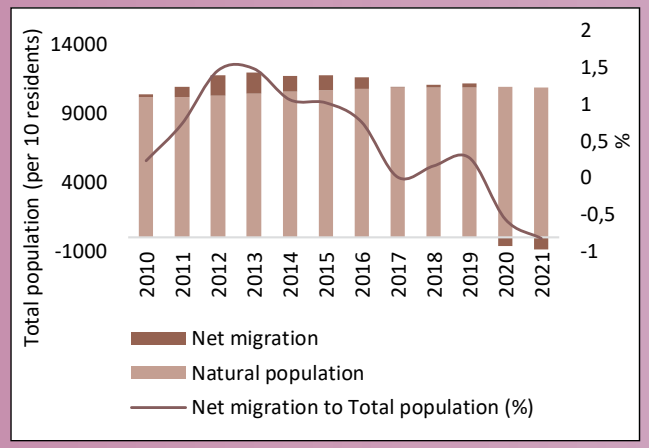
3.3. Drivers of affordable housing

Based on the conceptual framework presented in Chapter 2, this section summarizes the analysis and the results of the determinants of affordable housing. The domestic demand drivers are in Section 3.3.1., whereas the foreign demand drivers are examined in Section 3.3.2. The domestic supply conditions and factors are explored in Section 3.3.3.

3.3.1. Domestic demand drivers

With reference to population growth, the findings indicate that total population growth exerts a significant upward pressure on house prices (p<.001). However, further analysis reveals that whereas natural population growth is not related to an increase in median house prices (p>.10), the rate of net migration has a significant impact on median house prices (see Figure 12.1). More specifically, ceteris paribus, a one (1) percent increase in net migration is associated with a 0.2 percent increase in median house prices[18] (see Figure 12.2). Thus, rather than domestic demand (i.e., natural population growth), the findings indicate that foreign demand in the form of heightened immigration plays a significant (indirect) role in explaining house price appreciation. In fact, between 2012 and 2016, there was a significant increase in immigration numbers[19] (CBS, 2021; UN, 2022).

1.Housing affordability across gross annual median household income percentiles in 2021.



2. Required gross annual median household income for relatively affordable housing across regions in 2021.

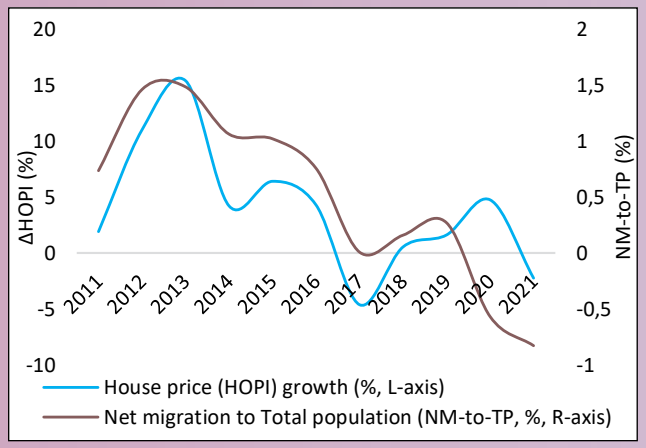


Figure 12. Population growth and median house prices. (Source: CBS, UN, CBA, Author's calculations)

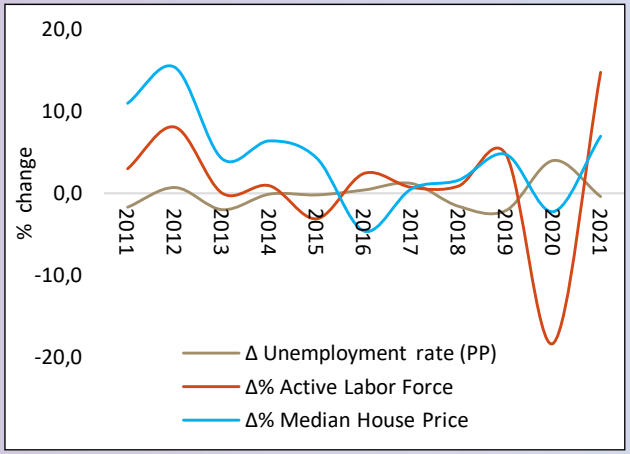
[18] *The findings are indicative, not conclusive; caution is warranted when interpreting measures of association.*

[19] *Couched as "tourism visitors", particularly from Venezuela.*

Labor force developments shape affordable housing dynamics. Additional robustness analysis indicates that (i) whereas a one (1) percentage point increase in the unemployment rate is associated with a (non-significant) 0.1 percent drop in median house prices (p>0.10), (ii) a one (1) percent increase in the active labor force is associated with a (non-significant) 0.2 percent house price appreciation (p>.10) (see Figure 13.2). Although exerting, respectively, downward and upward pressure on median house prices, the findings suggest that house prices are relatively unemployment inelastic, with the rate of unemployment having a relatively stronger impact on the loss of household income in comparison to house price depreciation.

The informal labor market is a critical underestimated factor in house market developments. Although preliminary, the findings suggest that the official unemployment rate is overestimated, whereas the official active labor force is underestimated. Hence, based on the available data and analysis, the impact of the informal labor market cannot be disregarded. It is highly plausible that the (growing) informal labor market (i.e., unregistered employment and earnings in select industries and sectors) plays an important – albeit currently underestimated – role in shaping affordable housing dynamics (through both demand and supply channels). This is a ripe area for future research.

1.Changes in unemployment rate, active labor force, and median house price.



2.Relatioship between change in active labor force and change in median house price.

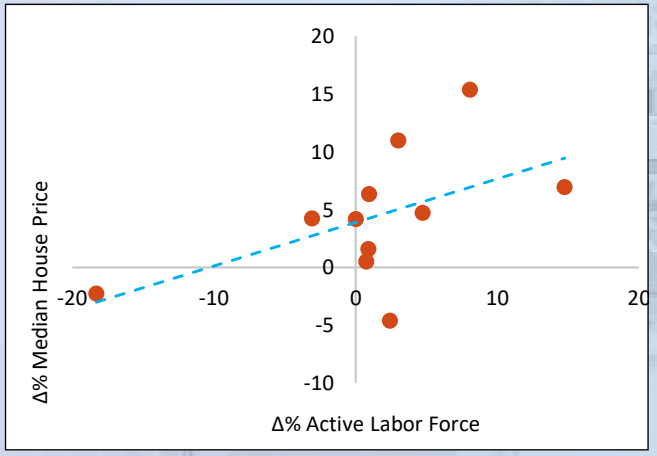
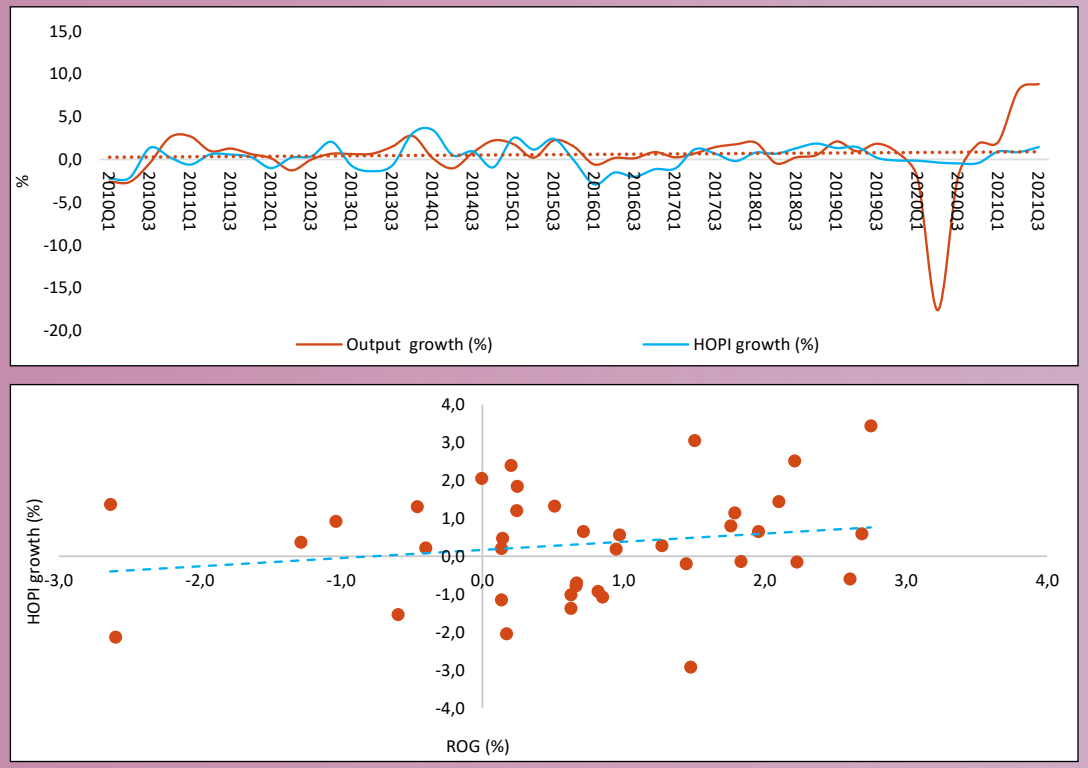


Figure 13. Annual change (%) in active labor force, unemployment rate, and median house price trends, 2011-2021.

Similar to labor market developments, the findings show that real GDP growth (between 2010 and 2021) is not significantly associated with house price appreciation (see Figure 14.1). Although a one (1) percentage point increase in real output growth (ROG) is positively associated with house price (HOPI) appreciation (+0.1 percent), the relationship is not significant (p>.10)[20]. Robustness analysis excluding the effect of the COVID-19 pandemic (in 2020) corroborates the negligible impact of ROG on HOPI appreciation (Figure 14.2).



1. Quarterly growth in real output (ROG) and median house prices (HOPI), 2010-2021.

2. Real output growth (ROG) and median house price (HOPI) appreciation, 2010-2019 (excluding COVID-19 pandemic shock).

Figure 14. (Source: CBA, DAO, Author's calculations).

[20] *The findings are indicative, not conclusive; caution is warranted when interpreting measures of association.*

Housing mortgages are a determining factor in shaping affordable housing dynamics. Turning towards the impact of credit supply and more specifically, housing mortgages and housing mortgage interest rates, the findings show that over the past two decades (2000-2021), total housing mortgages expanded significantly from Afl. 821 mln. in 2000 to Afl. 2,044 mln. in 2021 (see Figure 15).

Between 2010 and 2021, total housing mortgages increased by 42.1 percent. During the same period, housing mortgages by commercial banks grew from 61 percent to 72 percent. Interestingly, over the past decade, the share of housing mortgages by mortgage banks dropped from 15.4 percent to 9.7 percent (-Afl. 24.5 mln). Alternatively, the share of housing mortgages by pension funds rose by Afl. 52.1 mln.

Total housing mortgage (Afl. mln.) by type financial institution, 2000-2021.

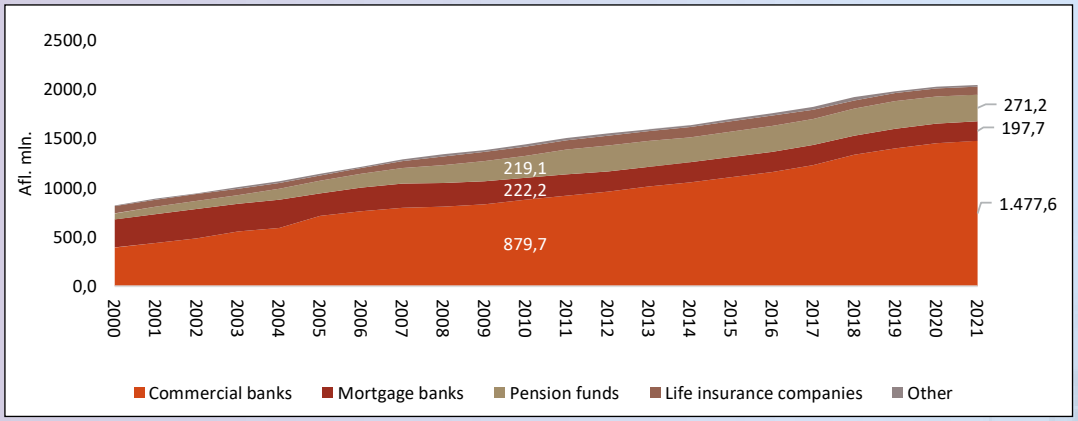


Figure 15. Total housing mortgages (Source: CBA).

Over the past two decades, the housing burden has increased significantly. Relative to nominal GDP, total housing mortgage loans inched up by 7.3 percentage points between 2010 and 2021, spiking at almost 45 percent in 2020 (see Figure 16.2), well above the 30 percent benchmark for prudent levels of mortgage debt to income and underscoring the increasing housing burden, particularly for low-income households. These findings corroborate a recent financial sector assessment by the IMF indicating that commercial banks have large and increasing exposures to the housing market via growing mortgage lending to households (CARTAC, 2022).

Despite an uptick in overleveraged households, financial stability remains safeguarded. As a prelude to the official introduction of borrower-based macroprudential policy guidelines and measures (e.g., Loan-to-Value (LTV), Loan-to-Income (LTI), and Debt-to-Income (DTI) benchmarks) by the Centrale Bank van Aruba (CBA), individual commercial banks apply conservative

mortgage loan standards, allowing an LTV of 75 to 80 percent for residents, and an LTV of 60 percent for non-residents purchasing a property on island (CARTAC, 2022).

Nonetheless, affordable housing remains challenging. For the average Aruban (middle-income) household, in particular, for the elderly and young(er) generations – including first-time homeowners earning less than the median household income –, affordable housing has become increasingly inaccessible (ATA, 2022; CBA, 2022). Although households can apply for financing housing mortgages up to 100 percent of a maximum housing mortgage loan of Afl. 350,000 by the *Fondo Nacional di Garantia pa Vivienda*[21] (FNGV, 2022), this limit to housing mortgage financing (i.e., estimated house market value of Afl. 437,500) is well below the median house price, especially in regions such as Noord-Tanki Leendert, Oranjestad, and Paradera where house prices have surged over the past decade.

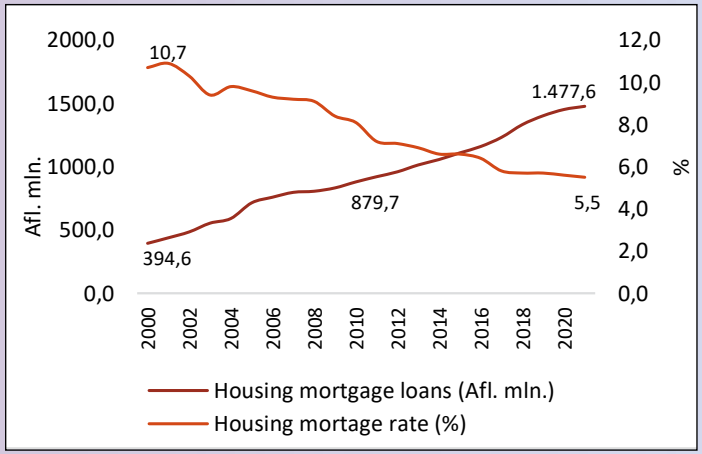
Housing mortgage rates have dropped significantly since 2000. Focusing on commercial banks, housing mortgage rates dropped by 5.2 percentage points, from 10.7 percent in 2010 to 5.5 percent in 2021 (see Figure 16.1). Concurrently, commercial banks' housing mortgages rose steadily by an average rate of 5.0 percent per annum between 2010 and 2021, although at a diminishing rate of growth in recent years; an early (proxy) indicator of increased housing burden (see Figure 16.3). The findings indicate that the decrease in housing mortgage rate has a significant impact on the median house price. Ceteris paribus, a one (1) percentage point drop in commercial banks' housing mortgage rate is associated with a 0.2 percent increase in median house prices ($p<.001$)[22].

[21] Founded on February 14th, 1997, 'Fondo Nacional de Garantia Pa Vivienda Foundation' (FNGV) was established by the Aruban Government. With the purpose of promoting home ownership to the inhabitants of Aruba, this initiative has led to a growth in housing construction in Aruba. Before the existence of the Foundation, anyone who wanted to finance their own property deemed to own at least 30% of the total value of the house as down payment. The FNGV Foundation guarantees up to 30% of the mortgage needed to purchase or build the home by collaborating with the financial institutions on the island. Since 1997, FNGV has assisted more than 3000 residents and made it possible to provide young starters the opportunity to receive a mortgage up to 100% for building or buying a house, funded by the financial institutions.

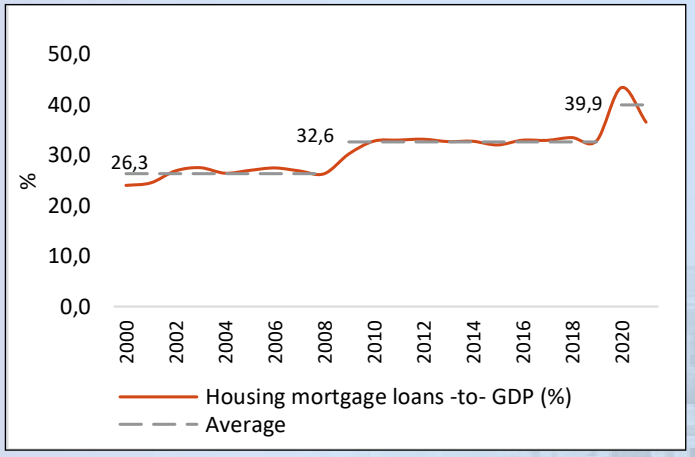
[22] The findings are indicative, not conclusive; caution is warranted when interpreting measures of association.

Figure 16. Developments in housing mortgage loans and rates (Source: CBA)

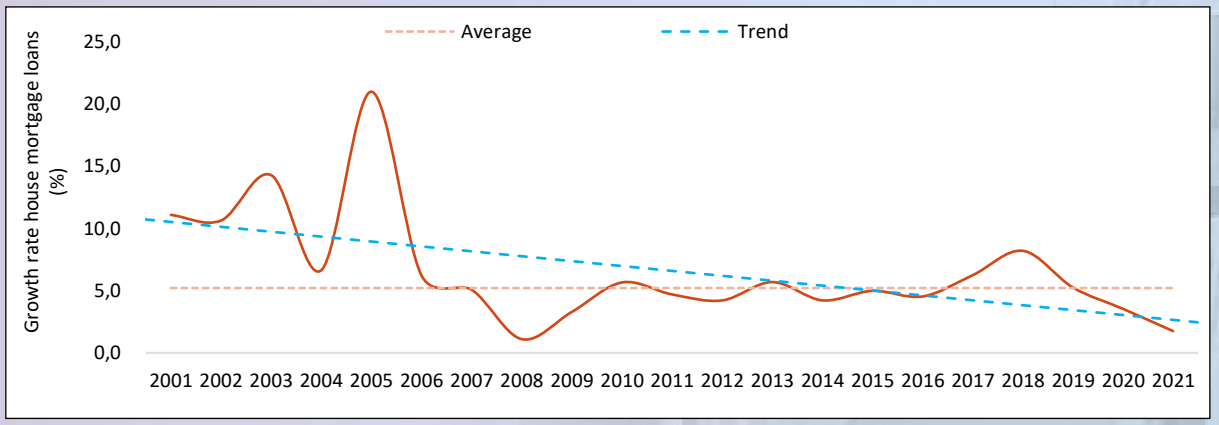
1. Commercial banks' housing mortgage loans and housing mortgage rates 2000-2021.



2. Total housing mortgage loans-to-nominal GDP (%) 2000-2021.



3. Diminishing growth rate in commercial banks' housing mortgage loans 2000-2021 (%).



In addition to the long-standing economic contribution of the tourism industry, the real estate industry has positioned itself as a prime industry and the 'second economic pillar' of the economy. Based on the national accounts by the CBS (from 2010 to 2018), as well as estimates and forecasts by the CBA (from 2019e to 2022f), analysis shows that whereas the accommodation and food service industry contributes (directly) an estimated 20 percent to nominal GDP, the real estate industry (including renting activities) currently contributes an estimated Afl. 610 mln. to gross domestic production, i.e., approximately 11 percent of nominal GDP (see Figure 17.1). The findings indicate that the economic contribution of the real estate industry expanded steadily over the past decade by an estimated Afl. 267 mln.

A similar shift is observed in the industry loan portfolio of commercial banks. In terms of loans offered by commercial banks to the real estate sector, the findings show that over the past decade, there is a striking surge in commercial banks' loans to the real estate industry (see Figure 17.2). A clear transition in commercial bank lending patterns is observed following the economic shock of the Global Financial Crisis (GFC) in 2009 and 2010. Up to 2011, almost half (47 percent) of commercial borrowing was by the wholesale and retail trade sector. By 2021, its share stood at 13 percent, dropping to less than Afl. 200 mln. in 2021. In tandem, the real estate share of commercial loans rose to almost 40 percent, more than tripling by Afl. 382 mln. (see Figure 17.2).

1.Stylized economic contribution of select industries to gross domestic production.

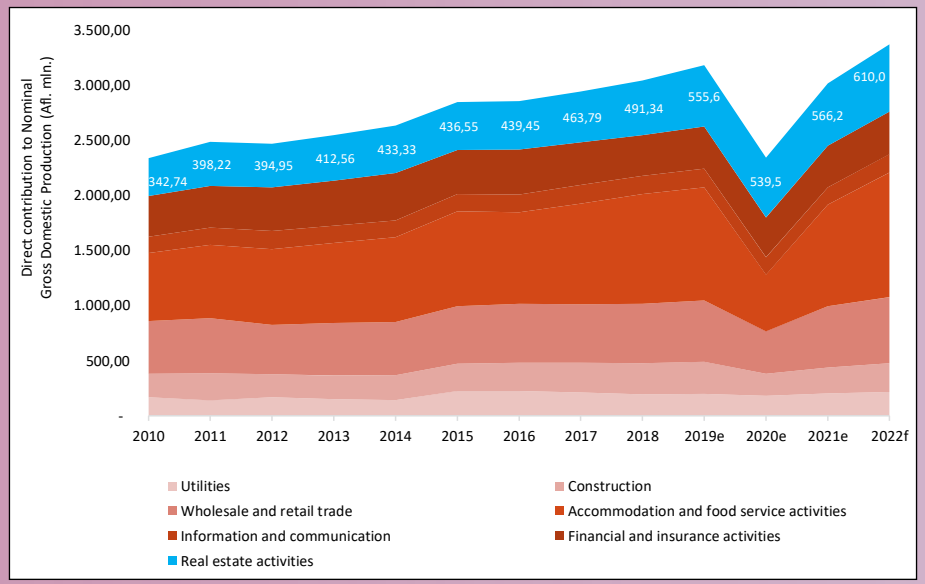


Figure 17. The rise of the real estate industry (Source: CBS (2010-2018); CBA (2019e-2022f)).

2. Total real estate loans (Afl. mln.) and real estate loans as share of total commercial loans (%).

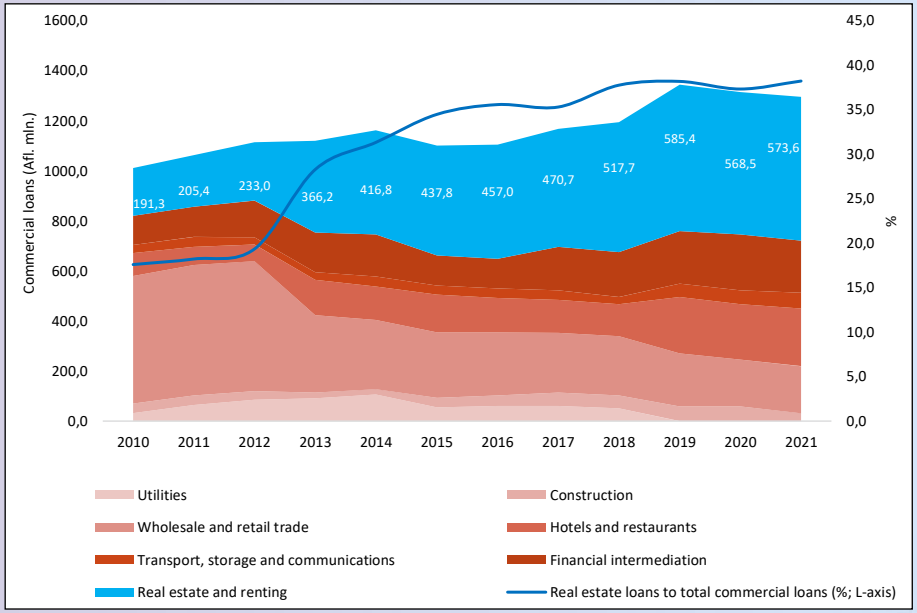


Figure 17. The rise of the real estate industry (Source: CBS (2010-2018); CBA (2019e-2022f)).

3.3.2. Foreign demand forces

As previously discussed in Chapter 2, foreign residential real estate investment (FREI) has an amplifying impact on domestic house prices. In the case of Aruba (see Figure 18.1), FREI – as recorded in the balance of payments (CBA, 2022) – amounted to Afl. 236 mln. in 2021, up by Afl. 227.3 mln. from 2000. Compared to 2010, FREI rose by Afl. 135.6 mln. (+136 percent). Consistent with real estate economic cycles (OECD, 2021; Quigley, 1999), FREI shows a distinct long-run cycle of expansion, contraction, recovery, and expansion between 2000 and 2021.

In 2021, FREI peaked at close to Afl. 70 mln. per quarter, more than double the long-run quarterly average of Afl. 30 mln. Although beyond the scope of this study, exploratory analysis indicates that while FREI has an initial positive impact on real output growth (ROG) – a one (1) percent increase in FREI is associated with a 0.2 percent growth in real output – between 2000 and 2009. However, this positive relationship no longer holds after 2010 (see Figure 18.2).

Is there a tipping point to FREI economic contribution? Subject to further investigation, these findings suggest that a

non-linear relationship exists between FREI and ROG, which results in diminishing returns after surpassing a certain FREI 'tipping point' (i.e., the vertex is estimated at Afl. 31.5 mln. per quarter). Based on previous studies, a likely explanation is that the economic contribution and benefits of additional FREI – beyond a certain optimum absorptive capacity and threshold of the domestic economic – are economically unequally distributed with significant economic leakages and capital outflows (Choi, 2006; Couto, 2018; Herzer & Nunnenkamp, 2011; IMF, 2021; Suanes, 2016; Zhang & Yang, 2020).

1. Quarterly foreign real estate investments, real output, and shocks 2000-2021.

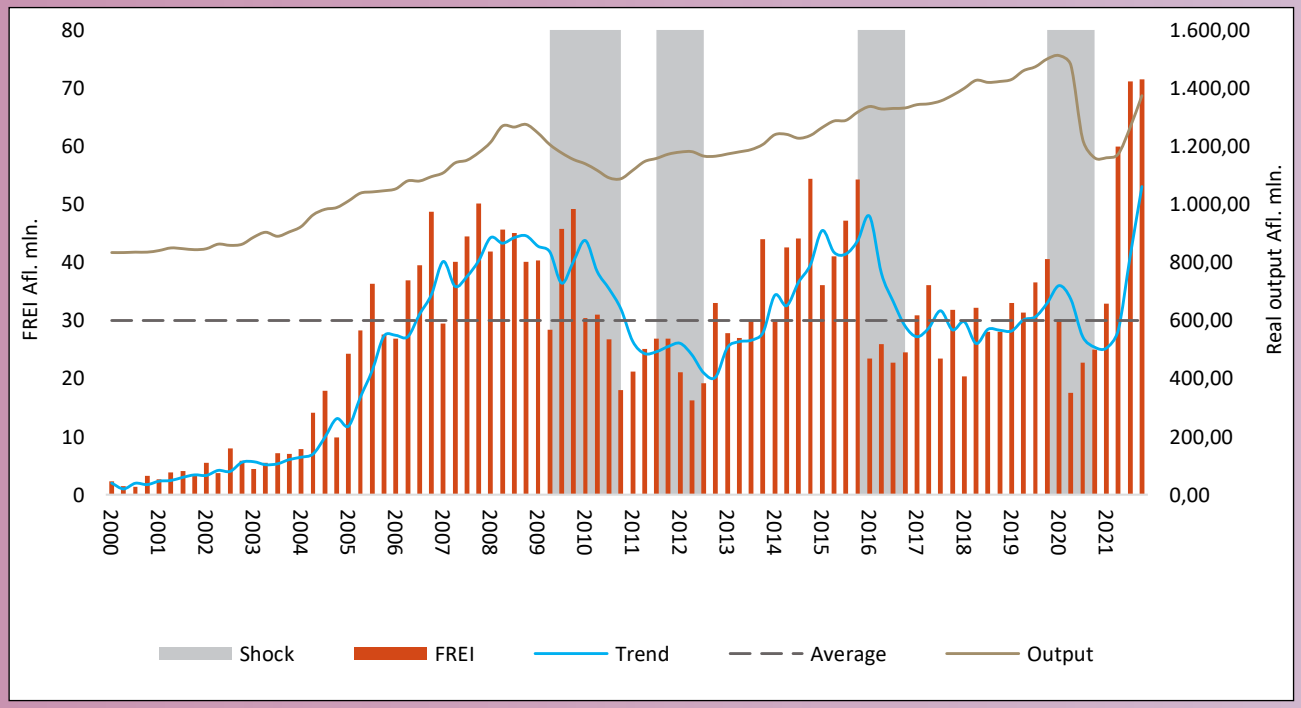


Figure 18. Quarterly developments in FREI and output, 2000 – 2021 (Source: CBS, CBA, Author's calculations).

2. Non-linear relationship between quarterly FREI (t-1) and quarterly ROG (2000-2021).

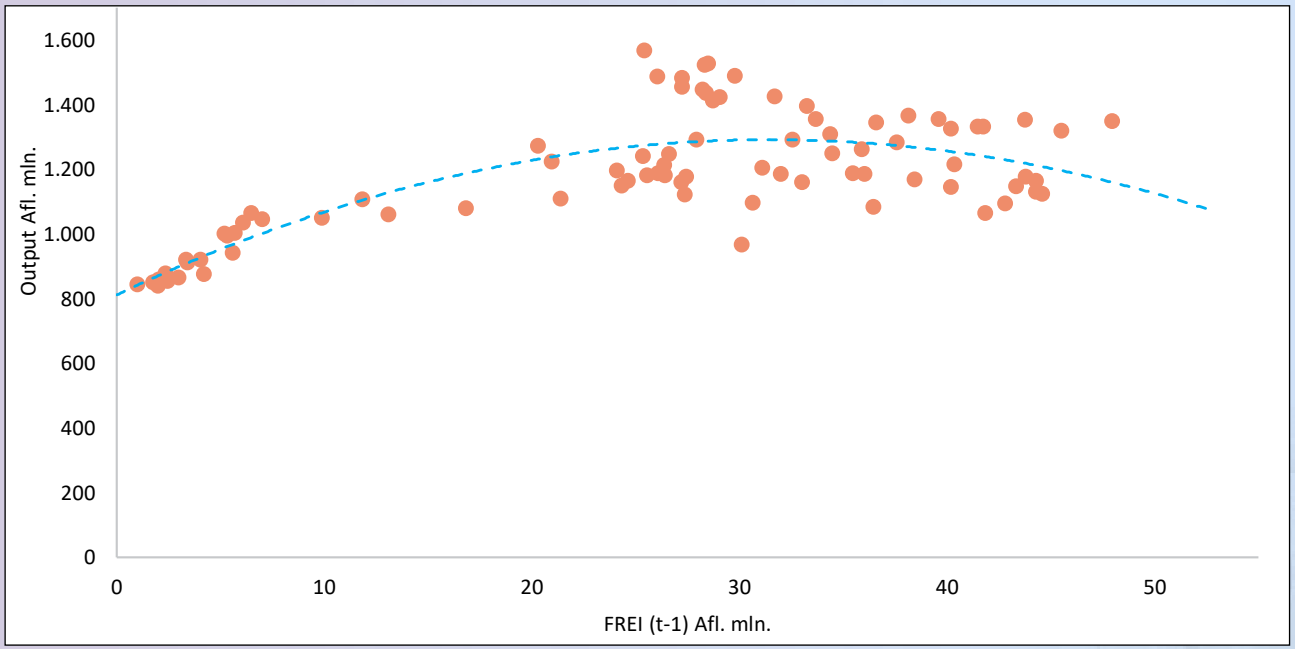
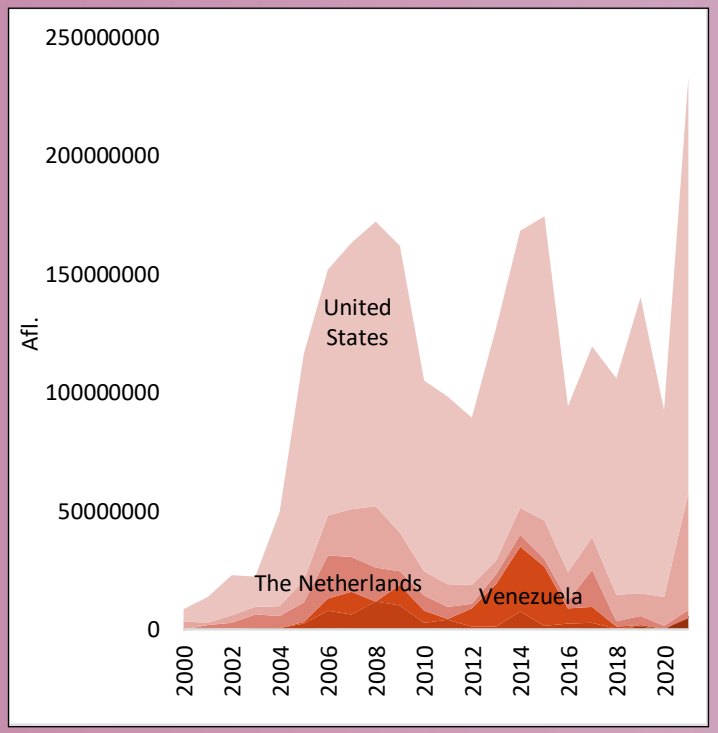


Figure 18. Quarterly developments in FREI and output, 2000 – 2021 (Source: CBS, CBA, Author's calculations).

Exposing the economic vulnerability of a small open economy, several foreign demand and economic shocks explain the FREI cycle over the past two decades. These shocks include the Global Financial Crisis (GFC, 2009-2010), the closure of the oil refinery (2012), the Venezuelan socioeconomic crisis (2015-2016), as well as the Covid-19 pandemic shock in 2020 (See Figure 19.1). Likewise, short-run upsurges are evident between 2005 and 2009 (financial risk buildup as a precursor to the GFC), as well as between 2012 and 2015 (Venezuelan government regime change), in addition to the post-pandemic surge in 2021. In terms of FREI-originating countries, an estimated 75 percent of FREI stems from the USA, with a significantly smaller portion originating from the Netherlands, Venezuela, Curacao, and Canada (see Figure 19.2). An estimated 11 percent of FREI is based on transactions conducted through notaries with a non-resident bank account. Moreover, these findings corroborate the previous results on the impact of immigration on population growth, and, subsequently, on housing demand and house price appreciation. More specifically, the upsurge in FREI originating from Venezuela is closely related to the uptick in immigration from Venezuela between 2012 and 2016.

1. FREI-originating countries (Inflow, Afl. mln.).



2.FREI distribution (%) across main countries.

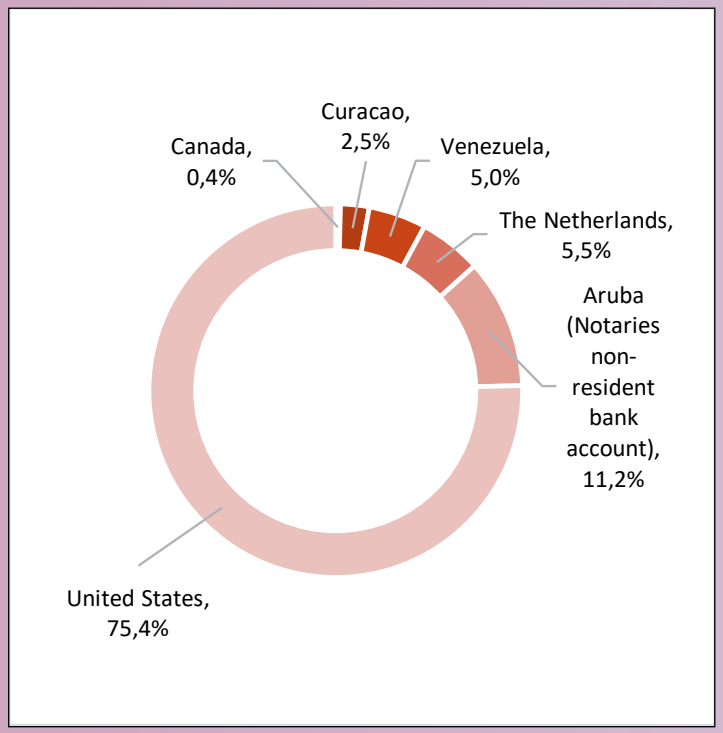
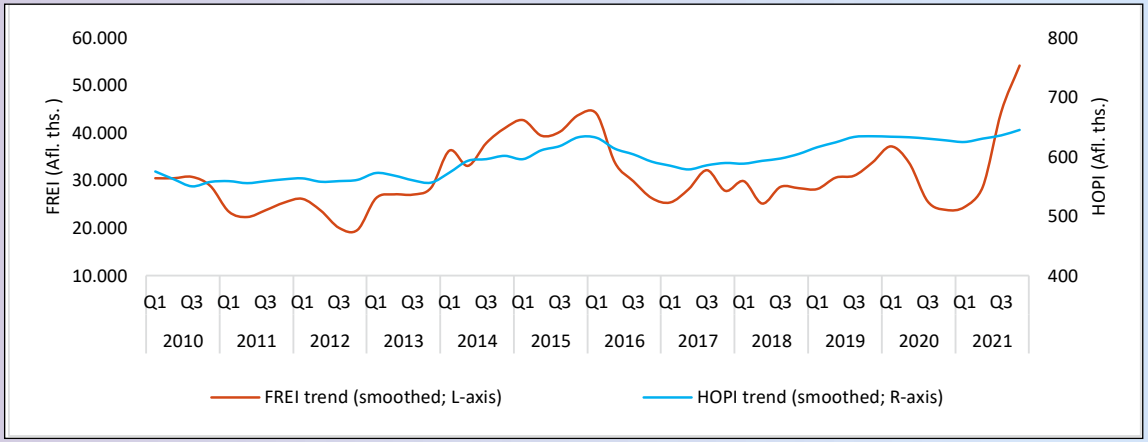


Figure 19. Main FREI-originating countries (Source: CBA)

The results show that there is significant co-movement between FREI and HOPI trends over the past decade (see Figure 20.1). Controlling for the time-lag effects of FREI (foreign residential real estate investment) and HOPI (median house price), analysis indicates that, ceteris paribus, a one (1) percentage point increase in FREI is associated with a 0.2 percent increase in HOPI[23]. At least one-third of the appreciation in HOPI is explained by the increase in FREI (Adjusted R2 = 38 percent; p<.001) between 2010 and 2021.

[23] *The findings are indicative, not conclusive; caution is warranted when interpreting measures of association.*

1. Quarterly FREI and quarterly HOPI trends, 2010-2021.



2. Relationship between FREI and HOPI, 2010 - 2021.

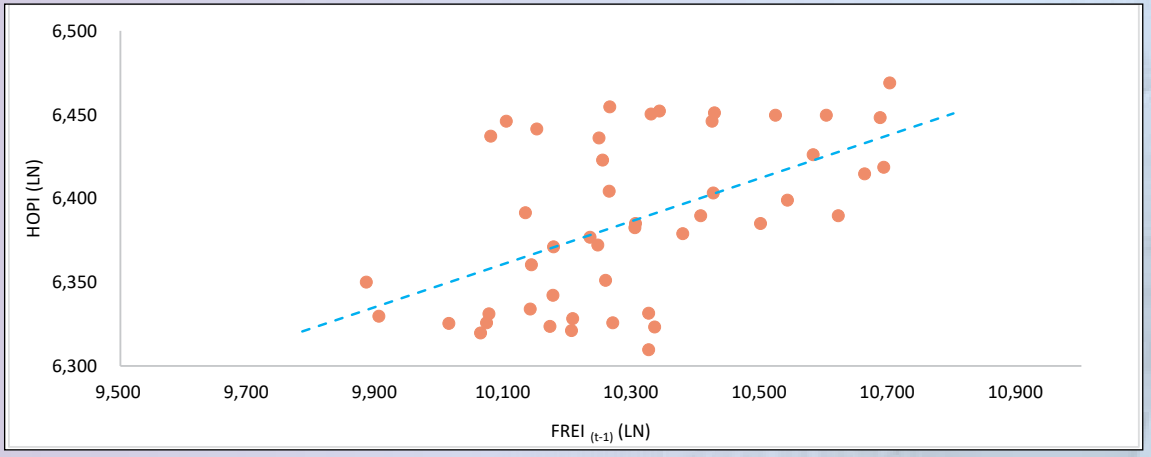


Figure 20. Foreign residential real estate investment (FREI) and median house price (HOPI) developments, 2010-2021 (Source: CBA, Author's calculations).

Moreover, the findings show that FREI is significantly associated with transfer tax revenues (TTR) from residential home purchases by non-residents (i.e., foreign investors) (see Figure 21). Controlling for the time-lag effects of TTR, the findings show that, ceteris paribus, a one (1) percent increase in FREI is associated with a 0.9 percent increase in TTR, explaining almost 25 percent of TTR income (Adjusted R2 = 24.6 percent; p<.05)[24]. These results corroborate previous findings on ownership of residential homes by non-residents. A robustness check based on the flat transfer tax rate (one-time tax) of 6 percent of the home sale value for non-residents shows approximately Afl. 210 mln. in FREI in 2021, i.e., Afl. 26 mln. less than the recorded FREI of Afl. 236 mln. in the balance of payments.

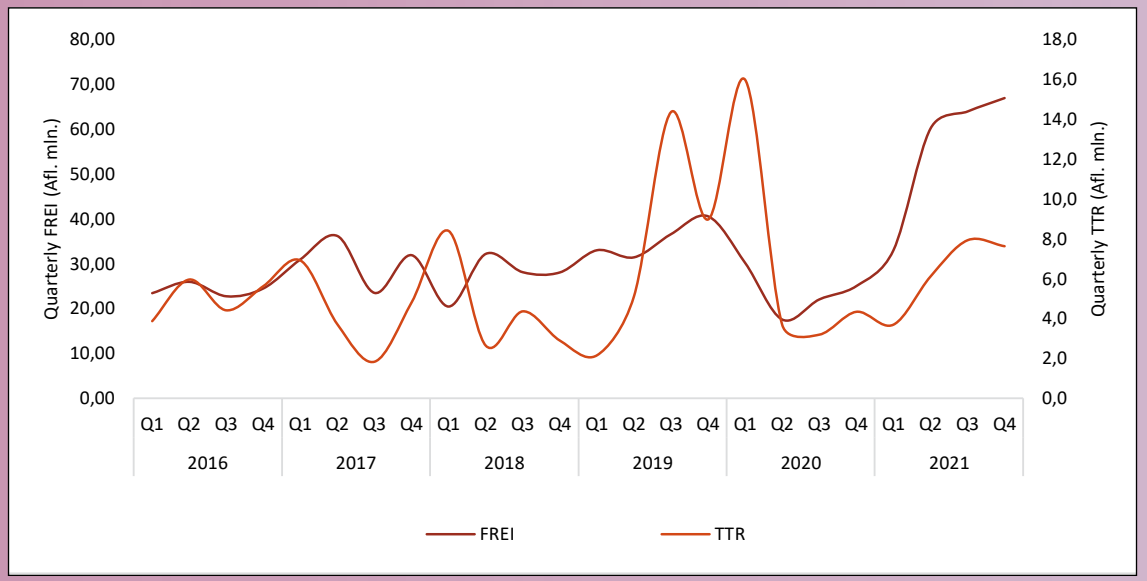


Figure 21. Foreign residential real estate investment (FREI) and transfer tax revenues, 2016-2021 (Source: CBA, DF, Author's calculations).

[24] *The findings are indicative, not conclusive; caution is warranted when interpreting measures of association.*

With reference to VHR tourism demand, Aruba has experienced a surging demand in VHR[25], especially from the North American market in recent years (see Figure 22). Whereas local VHR markets were relatively embryonic prior to 2015 – growing at an average rate of 3.9 percent –, over the past five years, VHR tourism demand soared with an average growth rate of 7.1 percent. In 2021, the VHR market rebounded by at least 11 percent. According to the Aruba Hotel and Tourism Association (AHATA), more than 20 percent of total stayover visitors are accommodated in a VHR property, whereas almost 30 percent of (reported) total visitor nights are spent in a VHR property (see Figure 23.1).

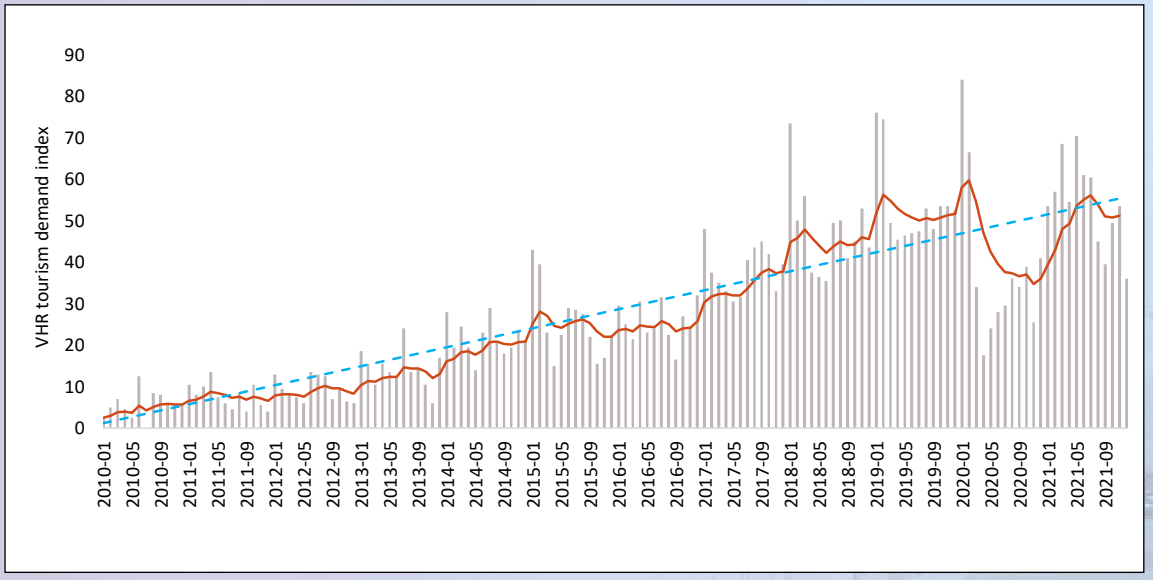


Figure 22. Aruba VHR tourism demand from North America between 2010-2021 (Source: Author's calculations based on Google Trends data for North American market).

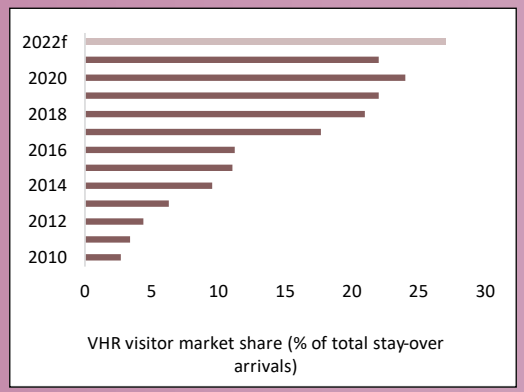
[25] *The Aruba VHR visitor demand is proxied based on a monthly index (from 0 to 100) using Google Trends data for the North American market.*

In terms of economic contribution, it is estimated that the Aruban VHR market yields close to Afl. 900 million annually in tourism revenues: on average, close to 30 percent of total tourism revenues (CBA, 2021). This is in line with estimates provided by the Vacation Rental Professionals of Aruba (VRPA, 2022). However, consistent with previous studies (Choi, 2006; Couto, 2018; Herzer & Nunnenkamp, 2011; IMF, 2021; Suanes, 2016; Zhang & Yang, 2020), the VHR leakage rate is estimated at 35 percent, i.e., there is a substantial capital outflow of at least Afl. 300 million in tourism revenues. The total economic contribution of the VHR market is conservatively estimated at 17.4 percent of GDP (in 2019 nominal GDP). Consistent with previous studies, analysis points out that, ceteris paribus, a one (1) percentage point increase in VHR tourism market share is associated with a 0.2 percent increase in median house prices[26] (see Figure 23.3).

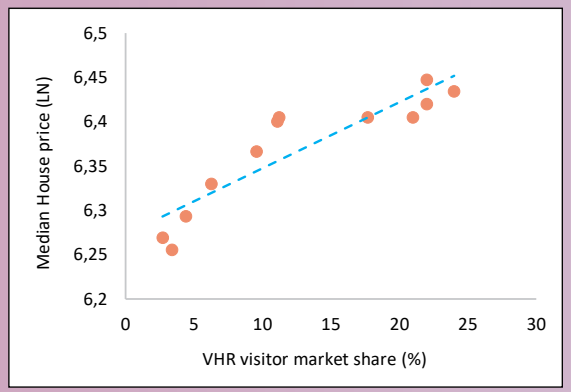
Figure 23 The Aruban VHR market (Source: AHATA, ATA, VRPA, CBA).

	2018	2019	2020	2021	4-year average
VHR visitor market share (%)	21	22	24	22	22
VHR nights market share (%)	26	28	29	28	28
Total tourism revenues (Afl. mln.)	3,619	3,742	1,915	3,170	3,111
Estimate VHR tourism revenues (Afl. mln.)	941	1,048	555	888	858
VRPA estimate VHR economic contribution (Afl. mln.)	-	-	-	862	-

1. Stylized facts of Aruban VHR tourism demand.



2. VHR visitor market share 2010-2022f.



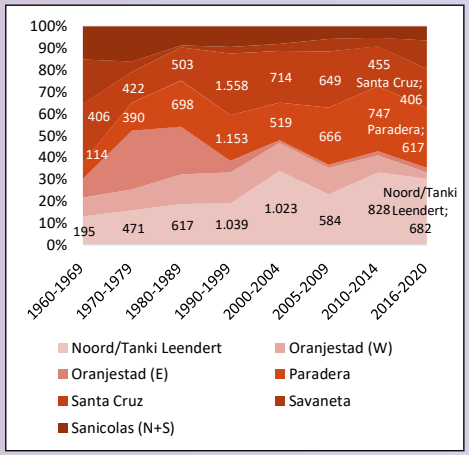
3. Relationship between VHR arrivals and house price.

[26] *The findings are indicative, not conclusive; caution is warranted when interpreting measures of association.*

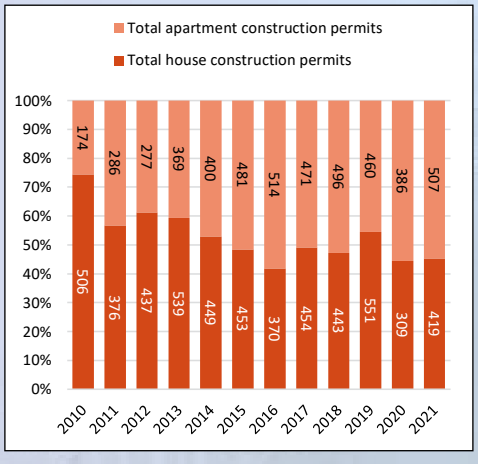
3.3.3. Domestic supply factors

Over the past decades, housing construction migrated across the island following the island's economic transformation from a largely oil-refining driven to a highly tourism-dependent small open economy (see Figure 24.1). Up until the 1960's, analysis shows that new housing construction was largely concentrated in San Nicolas, Santa Cruz, and Savaneta (i.e., Oil industry period). During the 1970's and 1980's, the epicenter of housing expansion shifted towards Oranjestad and Paradera (i.e., Pre-Status Aparte period). A third housing construction transition occurred during the 1990's (i.e., Tourism industry boom period) when new housing construction was largely centered in Noord-Tanki Leendert, Paradera, and St. Cruz. Commensurately, housing expansions diminished at an increasing rate in San Nicolas and Oranjestad. Over the past decade, new housing construction remains generally concentrated in Noord-Tanki Leendert, Paradera, and St. Cruz (CBS, 2021).

Of particular interest is the rise of apartment construction in recent years (see Figure 24.2). Analysis of permits issued for house and apartment construction (DOW, 2021) shows that there is an evident shift in relatively more apartment construction permits in comparison to house construction permits as of 2015. The number of permits issued for the construction of apartments surged by 190 percent between 2010 and 2021; on average, 17.4 percent annually. Alternatively, permits for housing construction dropped by 17.2 percent. In fact, with the exception of 2019, more than 50 percent of total residential construction permits issued were designated for the construction of apartments since 2015 (DOW, 2021). A partial explanation for this trend is the growing VHR tourism demand, explaining approximately 20 percent of the observed growth in apartment constructions in recent years (Adjusted R2 = 21.3 percent; $p < 0.01$).



1.Regional housing construction 1960-2020.

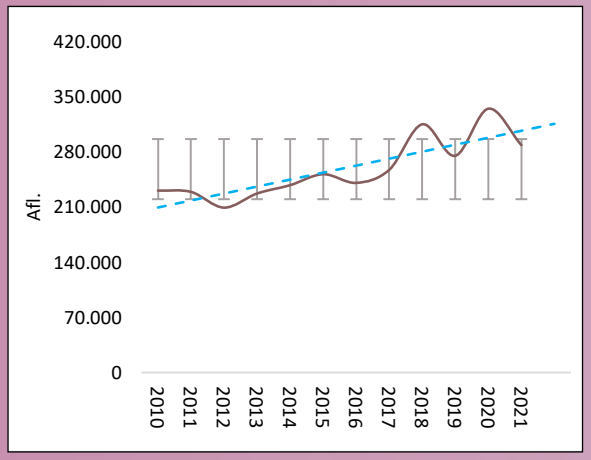


2.House and apartment construction permits issued 2010-2021.

Figure 24. Regional housing construction and construction permits issued (Source: CBS, DOW).

House construction prices increased significantly over the past decade. The findings indicate that the median price of (an average) house construction rose by at least 25 percent, from an estimated Afl. 230,000 to Afl. 288,000, between 2010 and 2021 (see Figure 25.1). Median house construction prices soared well above the average long-run trend after 2018[27]. Likewise, albeit slightly more volatile, the average house construction price per square meter increased by an estimated 40 percent to almost Afl. 2,400 in 2021 (see Figure 25.2). Analysis shows that, ceteris paribus, a one (1) percent increase in average house construction costs is associated with a 0.3 percent increase in the median house price between 2010 and 2021[28]. Furthermore, at least 10 percent of the appreciation in house prices is explained by the increasing constructions costs of housing (Adjusted R2 = 11.3 percent; $p < 0.05$).

1. Average house construction price trend and standard deviation (Permit value, 2010-2021).



2. Average house construction price per square meter trend and standard deviation, 2010-2021.

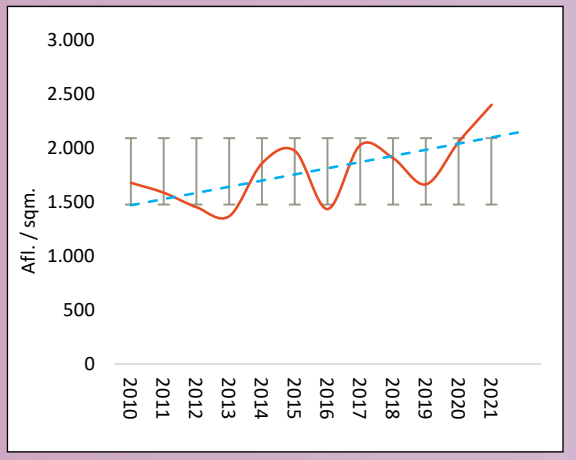


Figure 25. Average house construction permit value and house construction price per square meter (Author's estimates based on DOW, FCCA, and AAR data).

[27] *Measured by a growth of more than one-standard deviation point.*

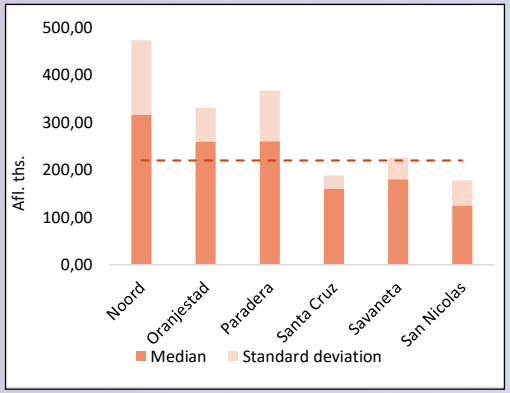
[28] *The findings are indicative, not conclusive; caution is warranted when interpreting measures of association.*

Over the past decade, available land for residential construction has become increasingly scarce, largely due to a confluence of different interrelated factors, including, population growth resulting from tourism expansions, and consequently, housing construction and rising housing density levels (DIP, 2020; ROPV, 2021). The scarcity of available land is especially noticeable in the regions of Noord-Tanki Leendert, Oranjestad, and Paradera, where the estimated price of land (per square meter) averages well above the (inter-regional) average price of Afl. 210 per square meter (see Figure 26.1). Whereas land is, on average, priced at an estimated Afl. 315 and Afl. 259 per square meter in, respectively, Noord-Tanki Leendert and Oranjestad, land is priced significantly lower in San Nicolas and Savaneta, ranging between Afl. 124 and Afl. 179 per square meter. In the case of Noord-Tanki Leendert, the price of land reaches well above Afl. 450 per square meter (see Figure 26.2).

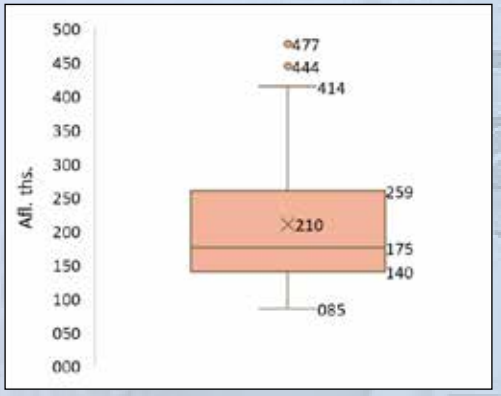
Analysis indicates that the relative differences in regional land prices partially explain the lack of affordable housing – for middle-income households – across different regions (e.g., Noord-Tanki Leendert and Oranjestad vis-à-vis San Nicolas and Savaneta) (see Figure 26.3). More specifically, considering the average costs of construction and average plot size per region, in addition to the average size of houses across regions, ceteris paribus, a one (1) percent increase in land price is associated with a 0.05-point increase in the regional PIR[29] (See Figure 26.3). The findings also show that the asking price of houses are, on average, at least 10 percent to 15 percent higher than the total estimated costs of house construction and land[30] (see Figure 26.4), particularly in the region of Noord-Tanki Leendert.

Figure 26. Median price of land per square meter (Source: DOW, FCCA, AAR, Author's calculations).

1. Average land price (Afl. per sqm.) per region.



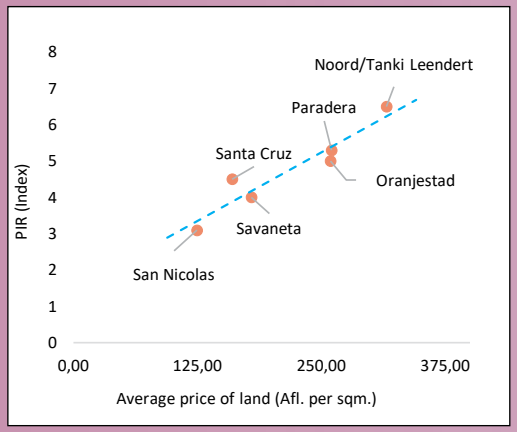
2.Median, quartile range, and outliers in price of land (Afl. per sqm.).



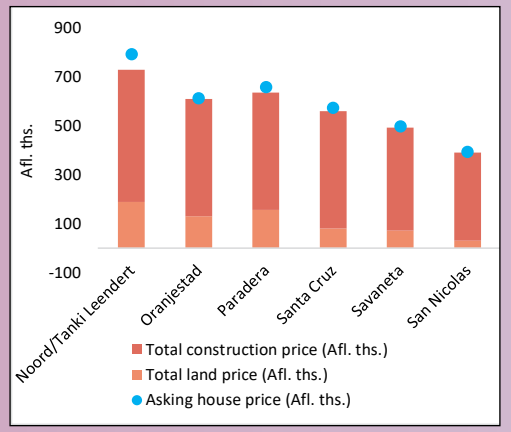
[29] *Due to the limited data points, some caution is warranted when interpreting measures of association.*

[30] *Including the price of land, yet excluding any additional amenities (e.g., pool, energy-efficient construction, etc.)*

3. Regional land price estimates and housing affordability.



4. Total estimate house construction costs, land price, and median house price.



The supply of VHR properties followed suit in the wake of surging VHR tourism demand. Practically non-existent a decade ago, today there are an estimated total 10,782 Aruban VHR properties registered on AirDNA of which 7,943 are listed as officially active[31] (AirDNA, 2022). An estimated 2,839 properties are either non-active or active on the informal (unregistered) VHR market (an estimated 26 percent of total listed VHR properties). Accounting for and excluding 1,375 condominium properties and corporate apartments, it is estimated that at least 5,153 VHR properties – with an estimated total of 9,275 rooms[32] – are operational in 2022 (see Figure 27.1). In relative terms, the VHR market accounts for at least 13 percent of the total housing stock.

VHR: the birth and burgeoning of a new sector. Whereas the VHR market was relatively nascent up until 2014 – counting an estimated 500 VHR properties –, and despite the Spatial Development Plan and Directives on limiting vacation home

[31] Although an estimated 2,829 VHR properties are listed as 'non-active' on AirDNA, these properties may still be operating through different off-line and on-line market channels. Alternatively, these VHR properties may be active on the informal (unregistered) market.

[32] According to AirDNA (2022), each VHR property has on average 1.8 rooms.

rentals[33] (ROPV, 2021), the VHR market soared to well over 5,000 properties by 2022, mainly driven by growing tourism demand and VHR market pull forces (see Figure 27.5). Analysis indicates that the surge in VHR properties is significantly associated with the appreciation of house prices over the past decade; ceteris paribus, a one 1 (one) percent increase in active VHR properties is associated with a 0.3 percent increase in the median house price ($p<.001$)[34].

Box 9. The professionalization of the VHR tourism industry (Source: VRPA).

Vacation Rental Professionals of Aruba

In 2021, the Vacation Rental Professionals of Aruba (VRPA) was established as an association.
According to the VRPA, the association was established "by a group of professional vacation rental owners to rightfully advocate and represent the best interest of vacation rental owners in Aruba, in a professional and diligent manner" (VRPA, 2022).
According to the VRPA:

"In the last few years, the vacation rental industry in Aruba has grown exponentially becoming a pioneer in the lodging industry in Aruba. It has become a necessity to have a professional platform to advocate on behalf of professional vacation rentals and help shape the future of the vacation rental industry in Aruba. Our mission is to empower industry improvements and standards through education in best practices and networking opportunities to its members, homeowners, guests, the government, strategic partners and other stakeholders, to promote a leveled playing field with sound regulations to ultimately unlock the full potential of Aruba as a vacation rental destination for the greater good of the community." [emphasis added].

During a policy summit organized by the VRPA policy summit about the economic contribution and jobs supported by the vacation rental industry, the founders indicated that "vacation rentals bring considerable economic impact to Aruba while supporting jobs". Moreover, "the vacation rental industry brought in 2021, an estimated $248.6 million US$ in direct vacation rental visitor spending, translating into US$ 478.7 million in total economic activity, creating just over 5,600 jobs.", according to

[33] *It is noteworthy that the aforementioned number of registered VHR properties (5,153) is more than double (x2.2) the reported 2,300 vacation home rentals (an estimated 45 percent of registered VHR properties) or registered 'recreational homes' in the Spatial Development Plan (ROPV, 2021). At least 55 percent of VHR properties are not registered in or accounted for in the Spatial Development Plan (ROPV, 2021). This suggests that, in addition to an estimated 2,829 VHR properties, the volume of VHR properties is severely underestimated by the ROPV and the Government's national records.*

[34] *The findings are indicative, not conclusive; caution is warranted when interpreting measures of association.*

the VRPA (2022). Moreover, the VRPA states there are currently 3,500 vacation home rentals registered in Aruba of which at least 50 percent is owned by residents[35] (VRPA, 2022).

Under the conservative assumption that 65 percent is locally owned (by residents), and 35 percent is owned by non-residents (i.e., an estimated 1,400 VHR properties), analysis suggests that approximately 24 percent of VHR properties – as registered by AirDNA – are owned by non-residents. This estimate is largely in line with the previous estimates – ranging between 22 percent and 25 percent – of residential dwellings owned by non-residents.

The majority of VHR properties[36] (69 percent) consist of guesthouses and residential homes (43 percent), as well as townhouses and villas (26 percent). Apartments and studios make up, respectively, 23 percent and 6 percent of the VHR market (see Figure 27.2). Condominium properties – excluded from further analysis in this study – constitute close to 18 percent of the market, of which most condos (an estimated 1,200) were built after 2016. Unlike residential homes, the surge in condominium properties largely constitutes new construction activities, rather than the remodeling and renovation of existing homes for vacation rental purposes.

In terms of total (room) accommodation capacity, the VHR market equals the traditional tourism accommodation market. The VHR market accounts for at least 9,000 rooms, thereby matching – if not surpassing – the total number of hotel rooms (an estimated 5,463 rooms) and timeshare units (an estimated 3,535) in 2022 (AHATA, 2022). Contrary to the Spatial Development Plan (ROPV, 2021), the total amount of (VHR and traditional tourism) accommodations already exceeds the stipulated maximum of 13,300 rooms for 2025, as well as the proposed maximum of 16,700 rooms in 2030[37].

Initial projections indicate that, ceteris paribus, the VHR market is expected to surpass 13,500 VHR properties (i.e., comprising at least 24,000 rooms) by 2030 (see Figure 27.1). Further comparative analysis suggests that the majority of VHR room units (98 percent) correspond with the estimated number of non-registered housing units by the CBS and total housing utility connections as reported by the WEB (see Figure 27.4). These findings corroborate previous findings that these non-registered 'housing units' are likely VHR properties used as recreational homes for tourism accommodation purposes.

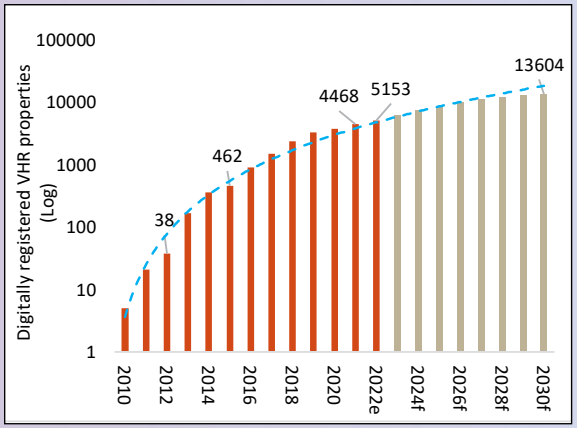
[35] According to a recent news release: "VRPA a indica cu for di datonan di e companianan profesional di maneho di propiedad di Vacation Rental, 50% di propiedadnan di Vacation Rentals ta di doñonan local." (NoticiaCla - VRPA: Vacation Rentals ta esencial pa desaroyo y stabilidad economico di Aruba, August 31, 2022).

[36] As registered and classified by AirDNA (2022).

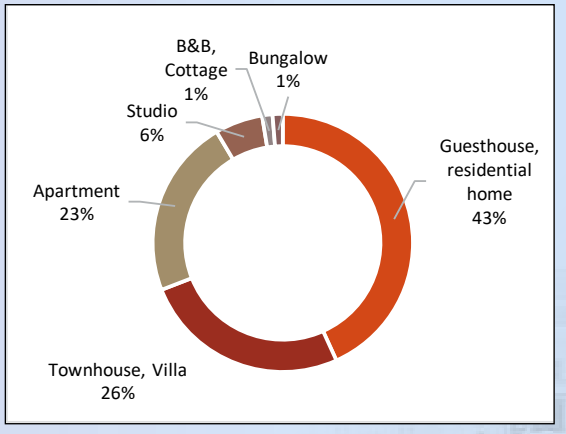
[37] In the case the ROPV (2021) is interpreted as the amount of VHR properties (as 'room units'), the total amount of accommodations (+14,000 accommodations: 9000 traditional tourism accommodations plus 5,100 VHR properties) would still exceed the limit of 13,300 accommodations stipulated by the ROPV (2021) for 2025.

Figure 27. Developments in the VHR maarket (Source: AirDNA, Author's calculations).

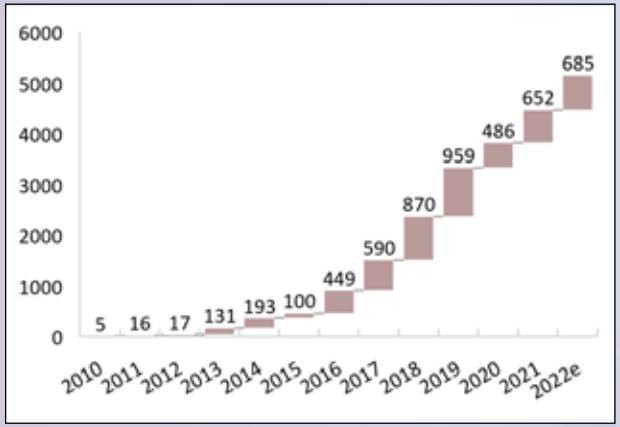
1. Digitally registered VHR properties 2010-2030f condominium properties excluded).



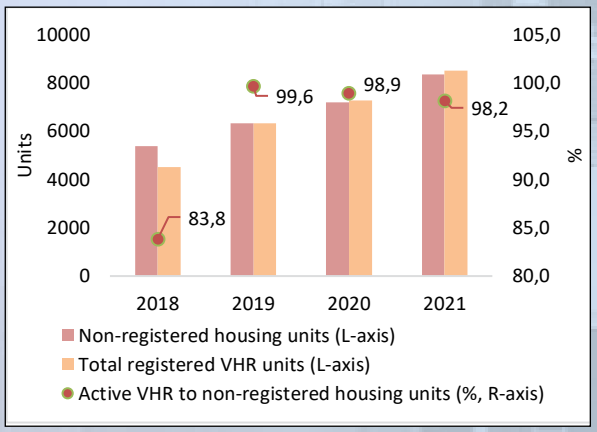
2. VHR properties by property type (condominium properties excluded).



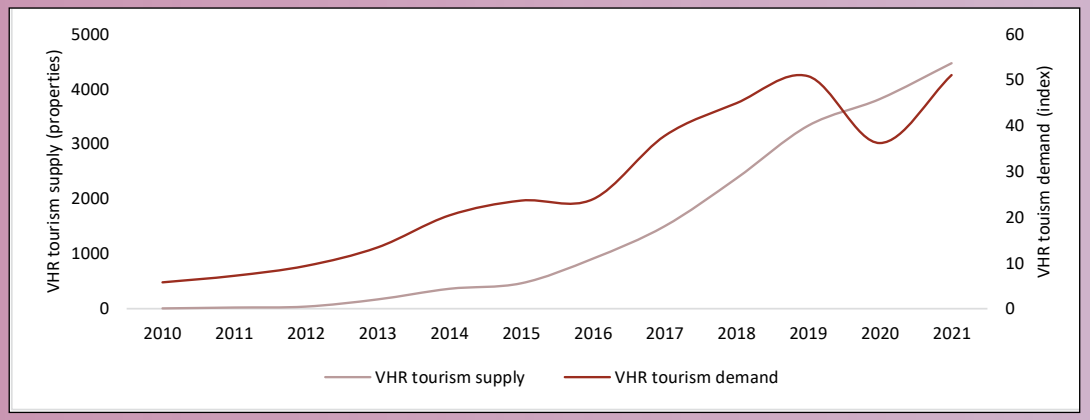
3. Annual growth of registered VHR properties (condominium properties excluded).



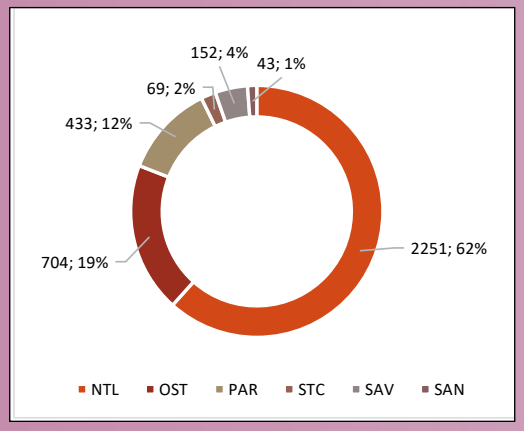
4. Estimate non-registered housing units and VHR properties (condominium properties excluded).



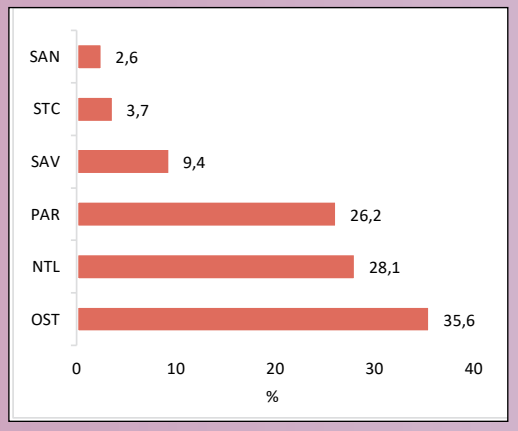
5.VHR tourism demand and VHR tourism supply trends 2010-2021.



Geographic analysis indicates that VHR properties are regionally concentrated and disproportionally distributed across different regions of Aruba. Geographic analysis of the VHR market shows that most VHR properties are located in Noord-Tanki Leendert (62 percent), followed by Oranjestad (19 percent) and Paradera (12 percent) (see Figure 28.1). Relative to the regional housing stock, an estimated 35 percent of residential properties in Oranjestad are designated as VHR properties, whereas 28 percent and 26 percent of houses in, respectively, Noord-Tanki Leendert and Paradera are allotted as VHR properties (see Figure 28.2).



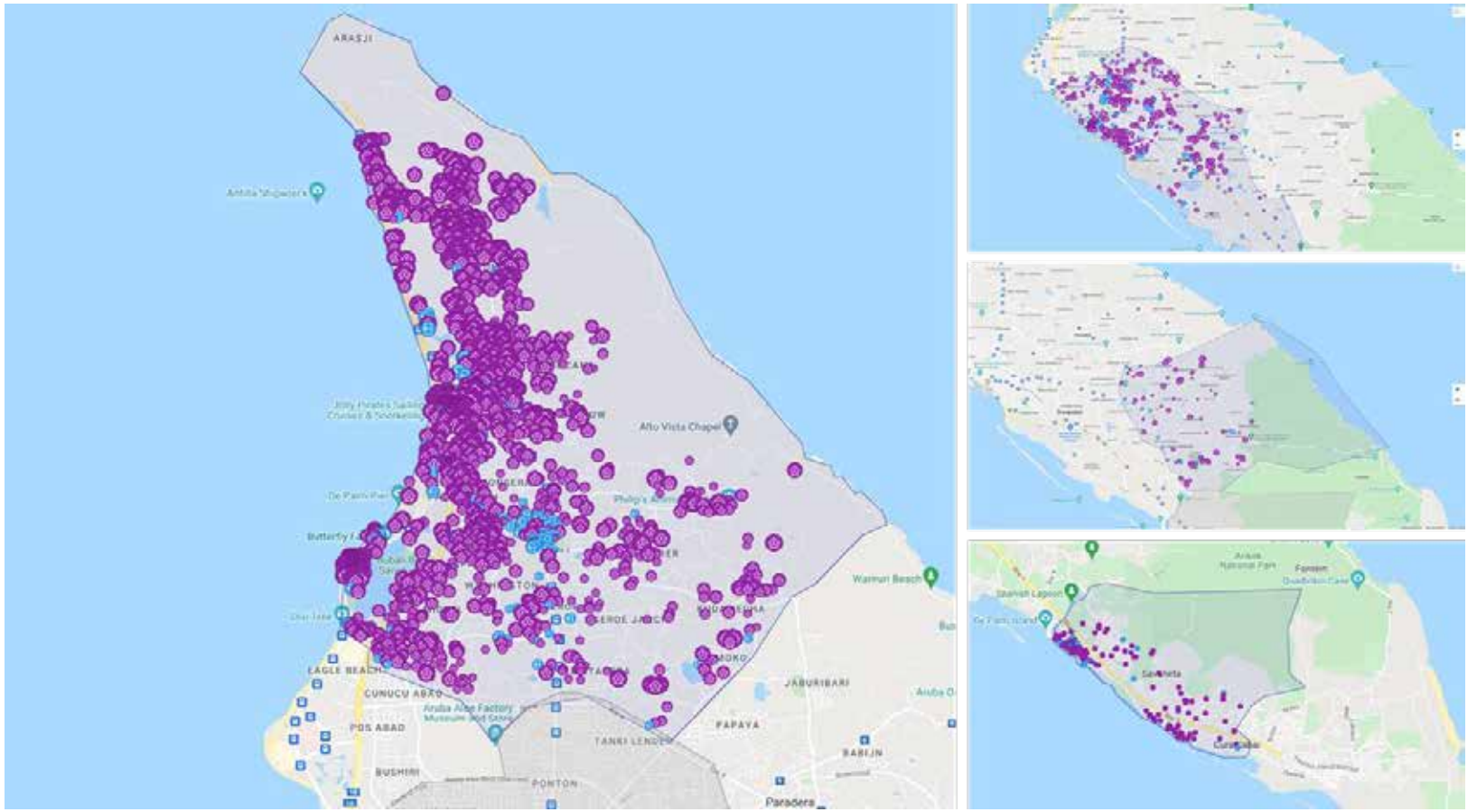
1. Regional VHR distribution as percentage of total VHR market.



2. Regional VHR concentration as percentage of regional housing stock.

Figure 28. Regional VHR distribution and concentration (Author's calculations based on AirDNA and CBS data, 2021).

3. Geographic distribution and concentration of VHR properties.

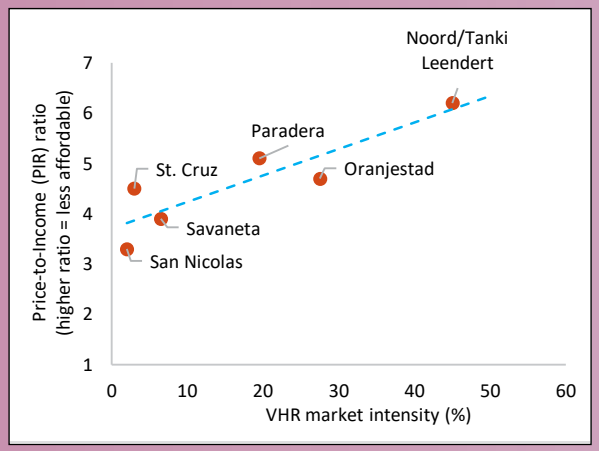


VHR market intensity has an adverse impact on regional housing affordability. Analysis shows that the intensity of the VHR market, as measured by the compounding effect of the VHR distribution rate and the VHR concentration rate (per region), exerts substantial upward pressure on the median house price, and consequently, on less affordable housing, especially in Noord-Tanki Leendert, Paradera, and Oranjestad (see Figure 29.1). Ceteris paribus, a one (1) percentage point increase in VHR market intensity is associated with a 0.1-point increase in the PIR ($p<.001$)[38].

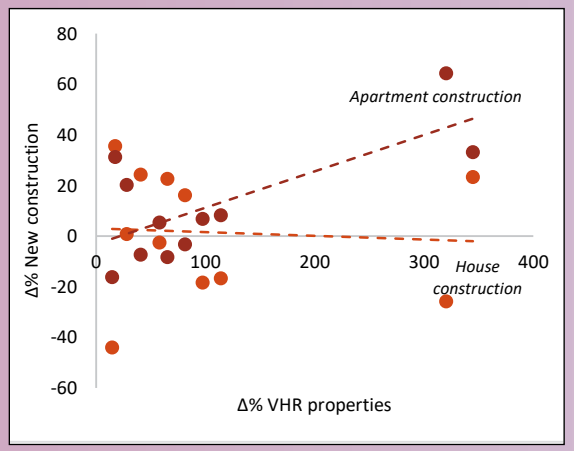
Does the VHR market crowd-out housing supply for residents? In terms of a crowding-out effect of the VHR market on house construction, the findings indicate that there is no significant ($p>.10$) association between the growth in the VHR market and house construction between 2010 and 2021 (see Figure 29.2). However, the results show that the expansion of the VHR (supply) market is significantly associated with the rise in apartment construction over the past decade. More specifically, a one (1) percent increase in VHR properties is associated with a 0.2 percent increase in apartment construction, considering equivalent conditions.

Figure 28. Regional VHR distribution and concentration (Author's calculations based on AirDNA and CBS data, 2021).

1. VHR market intensity and PIR across regions.



2. Change in VHR properties and new construction of houses and apartments.



[38] *Due to the limited data points, the findings are indicative, not conclusive; caution is warranted when interpreting measures of association.*

3.4. Discussion

Overall, the findings of this study indicate that housing has become increasingly unaffordable for low- and middle-income households over the past decade. The degeneration in affordable housing for residents is mainly due to the surge in house prices in tandem with sluggish developments in household income levels. These results are largely in concordance with reported affordable housing challenges and crises internationally and regionally (see Chapter 1 and Chapter 2).

Analysis shows that there are multiple factors that impact housing affordability (see Table 6). Consistent with previous studies (c.f., Algieri, 2013; Andrews et al., 2011; Anundsen et al., 2016; BIS, 2020; Capozza et al., 2002; Calder Sanchez & Johansson, 2011; Claussen, 2013; Cohen et al., 2017; Égert & Mihaljek, 2007; Geis & Luca, 2021; Geng, 2018; Girouard et al., 2006; Kallergis, et al., 2018; IMF, 2021; OECD, 2021), n***et migration and housing mortgage rates*** are significant domestic demand drivers of housing affordability. More specifically, net migration resulting from increased immigration in the short run (between 2010 and 2015 is a key driver of housing demand. In the long run (between 2010 -2021), housing mortgage rates are a structural driver of housing demand and affordability. Likewise, from a foreign demand perspective, the findings indicate that the ***rise in foreign residential real estate investment (FREI) and the surge in VHR tourism demand*** are structural factors that exert significant upward pressures on the house price-to-income ratio (PIR), consequently leading to relatively less affordable housing for residents, especially low- to middle-income households.

Foreign demand shocks amplify unaffordable housing. In concordance with previous studies (c.f., Ben-Yehoshua, 2008; BIS, 2020; Barron et al., 2017; Bivens, 2019; Choi, 2016; Couto, 2018; EU, 2021; Gascon, 2018; Gholipour, 2012; Gholipour & Masron, 2011; Herzer & Nunnenkamp, 2011; IMF, 2021; Mihaljek, 2005; Poon, 2017; Sa, 2016; Suanes, 2016; Van Noorloos, 2012; Wong et al., 2017; Zhang & Yang, 2020; Garcia-Lopez et al, 2019; IMF, 2021; Lee, 2021; Merante & Horn, 2016; Nieuwland & Van Melik, 2018; Zou, 2019; Bernardi, 2018; Calder-Wang, 2019; Cocola-Gant, 2016; Haar, 2018; Lee, 2016; Merante & Horn, 2016; Roelofson, 2018), FREI and VHR amplify and exacerbate the lack of affordable housing due to both a direct effect on housing affordability (i.e., transmitted through the house price appreciation channel), in addition to an indirect effect on domestic demand (i.e., immigration transmission channel) and domestic supply (i.e., VHR tourism supply transmission channel).

	Drivers	Average 2010-2015	Change[39](%) 2010-2015	Average 2016-2021	Change[39] (%) 2016-2021	Change (%) 2010-2021	Sign. difference (2010-2015 vs. 2016-2021)	Association housing affordability (PIR[40])
Demand (Domestic)	Real output growth	1.6	0.0	1.1	-0.5	-0.2	NS	+
	Natural Population	104,816	6.0	108,633	-0.9	5.1	NS	+
	Net migration	1,050	*369*	-35	-208	-480	**	+*
	Unemployment	8.6	-3.3	7.8	1.1	-2.2	NS	-
	Active labor force	50,488	10.7	50,942	-4.8	7.5	NS	+
	Housing mortgage rate	7.1	-1.5	5.8	-0.9	-2.6	***	-**
Demand (Foreign)	Foreign real estate investment	129,098,353	67.8	152,586,874	*63.9*	*110.3*	**	+**
	VHR tourism demand	12.6	477.9	41.1	*103.4*	*1,039*	***	+**

	Drivers	Average 2010-2015	Change[39](%) 2010-2015	Average 2016-2021	Change[39] (%) 2016-2021	Change (%) 2010-2021	Sign. difference (2010-2015 vs. 2016-2021)	Association housing affordability (PIR[40])
Supply	New house construction	40.4	-12.8	35.0	1.6	*-14.8*	*	-
	House construction price	231,007.0	9.0	291,901.7	*36.6*	*42.3*	*	+*
	Price of land	111.3	38.3	155.2	*27.7*	*86.2*	**	+*
	VHR tourism supply	1,020.3	179.0	3,168.3	*121.8*	*659.7*	***	+**

** p<.05, **p<.01, ***p<.005, NS=non-significant*

Table 6. Summary of drivers of housing affordability (Source: Author's calculations).

In turn, domestic supply further drives house prices relative to household income, thereby eroding housing affordability. More specifically, the general findings show ***that the increasing costs of housing construction as well as the price of land*** have a significant impact on housing affordability (i.e., higher PIR, less affordable housing). Likewise, ***the surge in VHR tourism supply,*** as measured by the flood in VHR properties, exerts substantial upward pressures on house prices – especially in certain regions and tourism zones –, in addition to the construction of apartments, which consequently partially substitutes the construction of houses, and dampens the supply of housing (for residents).

More poignantly, the results indicate that housing supply – although exerting downward pressure on housing affordability (i.e., lower PIR, more affordable housing) – has no significant bearing on housing affordability for residents.

[39] *The Levene test confirms equality of variances (homoscedasticity).*

[40] *A positive association (+) denotes an increase in the PIR and describes relatively less affordable housing. The effect is measured by the partial regression controlling for population and inflation.*

The fact that adequate housing supply has no significant impact on housing affordability is an essential, albeit not novel, finding by and of itself. It underscores previous policies and reports on the need of strengthening affordable and sustainable housing supply in Aruba (see, e.g., DIP, 2020; FCCA, 2010, 2020; ROPV, 2021).

The domestic supply of housing is catering largely to the growing demand stemming from foreign investors and VHR tourism, thereby displacing the dire housing needs of the community. The exigency of adequate and affordable housing for residents – especially low-income households and increasingly middle-income households – is emphasized, especially considering the pre-existing pent-up demand for social housing, the projections of population growth, surging house prices, in addition to future socioeconomic and environmental (climate) shocks; the latter likely to affect many residential coastal areas and households.

What is the collective impact of these demand and supply factors? To assess the conjoint impact of demand and supply factors on housing affordability, hierarchical stepwise regression (HSR[41]) analysis with an autoregressive lag is conducted. The hierarchical stepwise regression is primarily chosen in light of:

(i) the strong empirical basis for distinguishing demand-supply, as well as domestic-foreign dimensions;
(ii) It's application in previous studies on affordable housing and VHR tourism demand;
(iii) the recognition that house prices are 'sticky' and may be influenced by past (historical) house price transactions and expectations;
(iv) the need to mitigate the impact of multicollinearity between corresponding independent variables;
(v) the importance of identifying a core set of key determinants – strategic levers – for informing affordable housing policies.

Consistent with the HRS analysis, the effect of independent variables is reported in different interrelated 'blocks' for (1) domestic demand, (2) foreign demand, and (3) domestic supply (see Table 7). Within each block of factors, the significant variables are analyzed in an iterative (step-wise procedure) and only the significant results are reported. The findings indicate that an increase in net migration and a drop in housing mortgage rate are key domestic determinants of housing affordability (Adjusted R2 = 75 percent; $p<0.005$). In expanding the HRS with the block on foreign demand, results show that a rise in foreign residential real estate investments and a surge in VHR demand are additional drivers as well, over and above net migration (Adjusted R2 = 89 percent; $p<0.005$). Consistent with previous studies, these findings suggest that foreign demand 'overpowers' domestic demand in driving housing (un)affordability (i.e., higher PIR). In addition to the aforementioned domestic and foreign demand factors, after including the third block on domestic supply, the outcome corroborates the significance of increasing house construction costs and land prices, in addition to expansive VHR tourism supply as significant determinants (Adjusted R2 = 93 percent; $p<0.01$).

In relative terms, and notwithstanding the significance of supply conditions, the reported effects (coefficients) indicate that ***the confluence of rising VHR tourism demand and expansive***

[42] Stepwise regression is the step-by-step iterative construction of a regression model that involves the selection of independent variables to be used in a final model. It involves adding or removing potential explanatory variables in succession and testing for statistical significance after each iteration. The stepwise procedure is typically used on larger data sets for which it is not feasible to attempt to fit all of the possible regression models.

foreign residential real estate investments, in addition to decreasing housing mortgage rates, are key determining demand factors of housing (un)affordability[42]. Moreover, consistent with previous studies, the accelerated expansion and profound impact of the VHR market – in terms of both tourism demand and tourism supply – are prime factors in explaining the degeneration of affordable housing for residents, especially low- to middle-income households in key regions of the island.

	Dependent variable: Housing affordability (PIR) Control variables*: House price (lag), inflation, and RER		
Independent variables	Block: Domestic demand (*β, p*)	Block: Foreign demand (*β, p*)	Block: Domestic supply (*β, p*)
Net migration	+.56*	NS	NS
Housing mortgage rate	-.77***	-.68***	-.55***
Foreign real estate investment		+.49***	+.40***
VHR tourism demand		+.89***	+.68***
House construction costs			+.22***
Price of land			+.12***
VHR tourism supply			+.25***
F-test significance	***	***	**
Adjusted R^2	.75	.89	.93
R^2 change significance		(+.14)**	(+.04)**

** p<.05, **p<.01, ***p<.005, NS=non-significant*

Table 6. Summary of drivers of housing affordability (Source: Author's calculations).

[42] *In the context of the Aruban housing market between 2010 and 2021.*

4. Conclusions

"It is hard to argue that housing is not a fundamental human need. Decent, affordable housing should be a basic right for everybody in this country. The reason is simple: without stable shelter, everything else falls apart."

Matthew Desmond

4.1. Key insights and future research

Indeed, housing matters. The pursuit of affordable housing is central to sustainable development. Affordable housing is fundamental to inclusive development and socioeconomic wellbeing. More than housing, a home is vital to people's lives, health, dignity, safety, and their neighborhoods. A housing community contributes to social solidarity, environmental sustainability, and economic stability, if and when piecemeal laissez-fair housing planning and development are transformed to concerted, impactful, and targeted affordable housing policies that emphasize inclusion, responsibility, and resilience (OECD, 2021, UN, 2021).

The main purpose of this study was to investigate the current state of affordable housing and explore the impact of various demand and supply drivers that influence housing affordability for residents. With regard to the state of affordable housing, the findings of this investigation yields the following key insights and lessons learned.

Over the past decade, housing has become increasingly unaffordable for residents. The affordable housing problematique is mainly the result of (i) surging house prices, (ii), relatively stagnant (average) household income levels, in addition to (iii) sluggish housing supply. On average, housing affordability deteriorated significantly over the past decade, as measured by the rising PIR from 3.3 in 2010 to 5.9 in 2021. Consequently, the gap between what households earn and the price of housing and home ownership has widened. Unless appropriate policy measures are taken to simultaneously tame the (foreign) tide in housing demand and, simultaneously, transform affordable housing supply, the housing affordability gorge is projected to further deepen and widen in the medium-term future.

Housing is largely unaffordable for low- and middle-income households. Housing affordability is especially challenging in the regions of Noord-Tanki Leendert, Paradera, and Oranjestad, where the median house price is at least five (5) times higher than median household income. Furthermore, the regions of St. Cruz and Savaneta are showing early signs of unaffordable housing, largely due to the increase costs of housing construction and land price, as well as the growing presence of VHR properties. Currently, there are few options for low-income households who rely almost exclusively on the (limited) supply of social housing. Moreover, absent sufficient household savings or financial collateral, first-time homeowners and young(er) middle-income households may be challenged when seeking housing mortgage financing for 100 percent due to the housing mortgage guarantee loan cap of Afl. 350,000 that is well below the median house price. More specifically, whereas middle-income households earn more than the maximum allowed household income for social housing, they also don't earn enough to afford a house on the private market. In effect, middle-income households are being 'squeezed out' of affordable housing.

Increasing levels of housing burden and housing poverty are more prominent in the community (amongst residents). Consequently, these adverse developments are fueling a nascent housing affordability crisis, engendering social displacement of Aruban households who can't affording a home, and bolstering exclusive (non-inclusive) housing development. Similar to Bonaire, Curacao, St. Maarten and other Caribbean small island tourism economies (IDB, 2016; WB, 2020), the Aruban housing market seems to be bifurcated and structured according to two demand-supply chains, i.e., (i) the private real estate and vacation home rental sector that caters largely to foreign investors, and (ii) the social housing foundation and local entrepreneurs who predominantly serve low- to middle-income residents and immigrants. This divergence exacerbates the housing affordability problematique.

The affordable housing problematique is not unique to Aruba. The challenge of housing affordability is a global phenomenon with dire domestic implications, especially in small tourism island economies that face a complex mix of economic and social vulnerabilities, in addition to mounting environmental and climate risks. Several other countries, including Curacao, Bonaire, and St. Maarten report a surge in house prices over the past decade, and subsequently, the widening gap between house price appreciation and stagnant household income levels. This situation is no different in the Netherlands and the rest of Europe, where the resolution of affordable housing has gained prominence on the EU policy agenda. Interestingly enough, despite these shared housing affordability concerns throughout the Kingdom of the Netherlands, and notwithstanding the intentions of the so-called 'country action programs' (i.e., in Dutch, 'landspakketten') to strengthen the resilience of Curacao, Aruba, and St. Maarten, fostering affordable housing – or any housing matters – are not included in the respective 'country action programs'.

A confluence of multiple demand and supply factors drive unaffordable housing (see Figure 30). From a domestic demand perspective, population growth stemming from immigration, in addition to accommodating housing mortgage rates are conducive to higher house prices, and consequently, less affordable housing in the long run. Amplifying domestic demand are the rise in foreign real estate investment and the surge in VHR tourism demand. Moreover, unaffordable housing is exacerbated due to the rising costs of house construction, the scarcity of land (hence, land price increases), as well as the growth and the (regional) concentration of VHR properties. As a result, the growing VHR market adversely affects housing affordability through both demand as well as supply transmission channels, especially in the absence of potential economic and financial benefits accruing collectively and structurally to (domestic) household income. The unfolding of this unfortunate and unsustainable development is akin to the classical 'tragedy of the unmanaged commons' (Hardin, 1968), in which although individual gains may be derived in the short run, the collective community suffers the brunt of loss and costs in the long run, especially future generations that may no longer be able to acquire and afford their own home in Aruba.

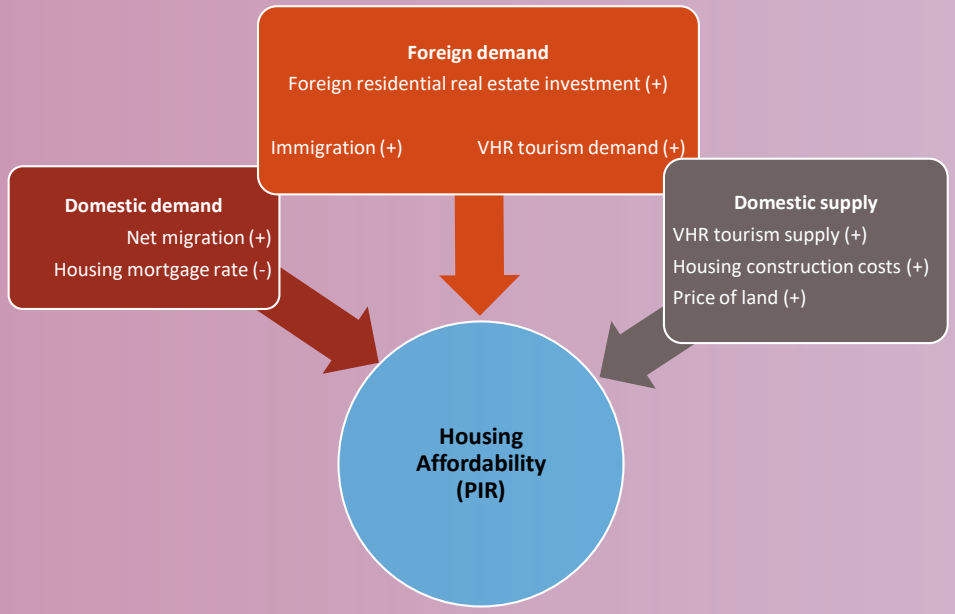


Figure 30. Stylized demand and supply drivers of housing affordability.

Inclusive development is seriously jeopardized by the lack of affordable housing. Due to the enduring nature of the affordable housing problematique, ensuring access for all to adequate and affordable housing (i.e., SDG11) is still largely a 'work-in-progress'; one that needs concerted policy attention and policy actions. Considering the current trends in unaffordable housing, as well as the projected developments for housing demand, in addition to the apparent lack of a national cohesive policy for affordable and sustainable housing, the risk of social exclusion and increasing levels of (housing) poverty are clear and present. Hence, absent structural policy shifts to foster affordable housing for residents – especially low- to middle-income households –, inclusion and resilience remain unattainable in the quest for sustainable development.

Considering the delimitations of this exploratory study, in addition to new questions arising from the main findings, there are several avenues for future investigation, including:

I. ***The results of this study are confined to the case of Aruba, spanning a decade between 2010 to 2021.*** Hence, the generalization of these findings is limited and calls for future comparative studies of other small open economies, especially small island tourism economies that are facing

similar developments in domestic and foreign demand, as well as domestic supply. The further investigation of, e.g., Curacao, Bonaire, and St. Maarten would contribute significantly to the body of knowledge and policies on fostering affordable housing for inclusive development in contemporary Caribbean island societies.

II. ***This study focused mainly on income affordability, whereas loan affordability and mortgage affordability were secondary dimensions of analysis.*** Future studies should conduct a holistic analysis of these interdependent dimensions of affordable housing in order to provide a more comprehensive picture of key challenges and relevant housing policies.

III. ***In focusing on housing affordability, this investigation relied primarily on the measurement of the price-to-income ratio (PIR) approach.*** Future research should expand this initial measure by examining measurements of housing burden (i.e., the expenditure-to-income ratio approach) and housing poverty (i.e., the residual income approach) as well. Furthermore, this study did not include any subjective (perceptual) measures of housing affordability by residents. Although reference is made to several national surveys containing household perceptions of unaffordable housing and housing costs (e.g., ATA, 2022; CBA, 2021), future research is recommended to capture the full spectrum of both objective and subjective measures of affordable housing.

IV. ***Moreover, whereas affordable housing was the main theme of this investigation, the question of adequate housing remains unanswered.*** Adequate housing complements affordable housing and measures the suitability of housing facilities, including the use of certain types of construction materials, type of roofing, and housing energy efficiency, as well as basic kitchen, utility, and sanitation facilities (see, e.g., CENSUS 2020, CBS, 2021). Housing adequacy is fundamental the health and wellbeing of households (UNSDG, 2021) and requires further investigation.

V. ***In addition, housing adequacy is especially relevant to coastal residential areas that are highly exposed to the risks and adverse impacts of climate change, including, extreme weather events (e.g., flooding) and sea level rise*** (see Figure 31.2; Figure 31.3). Previous studies indicate that at least 45 percent of housing units are located in coastal residential areas, and are especially prone to storm surges and floods (Peterson, 2021). Initial observations show that a significant share of VHR properties is located in climate risk zones (see Figure 31.1), and is likely to be severely affected by climate change in the next decade(s). Hence, future research is essential for developing a comprehensive understanding of the housing risks and impacts of climate change, in addition to the required policy measures and actions to strengthen climate resilience. The latter is also particularly relevant for safeguarding financial stability and the financial wellbeing of households.

VI. ***This investigation concentrated primarily on affordable housing for low- to middle-income households.*** Although the findings report the growing need of social housing for low-income households, more in-depth research is required to gain a comprehensive understanding of the complexity and dynamics of social housing for other vulnerable groups, including specifically, younger generations, single-parent households, and the elderly. This would contribute to targeted social housing policies and programs;

1. Geographic distribution of VHR properties (residential in purple) and apartments in grey).

2. High-risk and -impact flooding zones (light and dark blue dots indicate existing flooding zones).

3. High-impact zones of +1m sea lever rise (simulation; purple marks sea level rise).

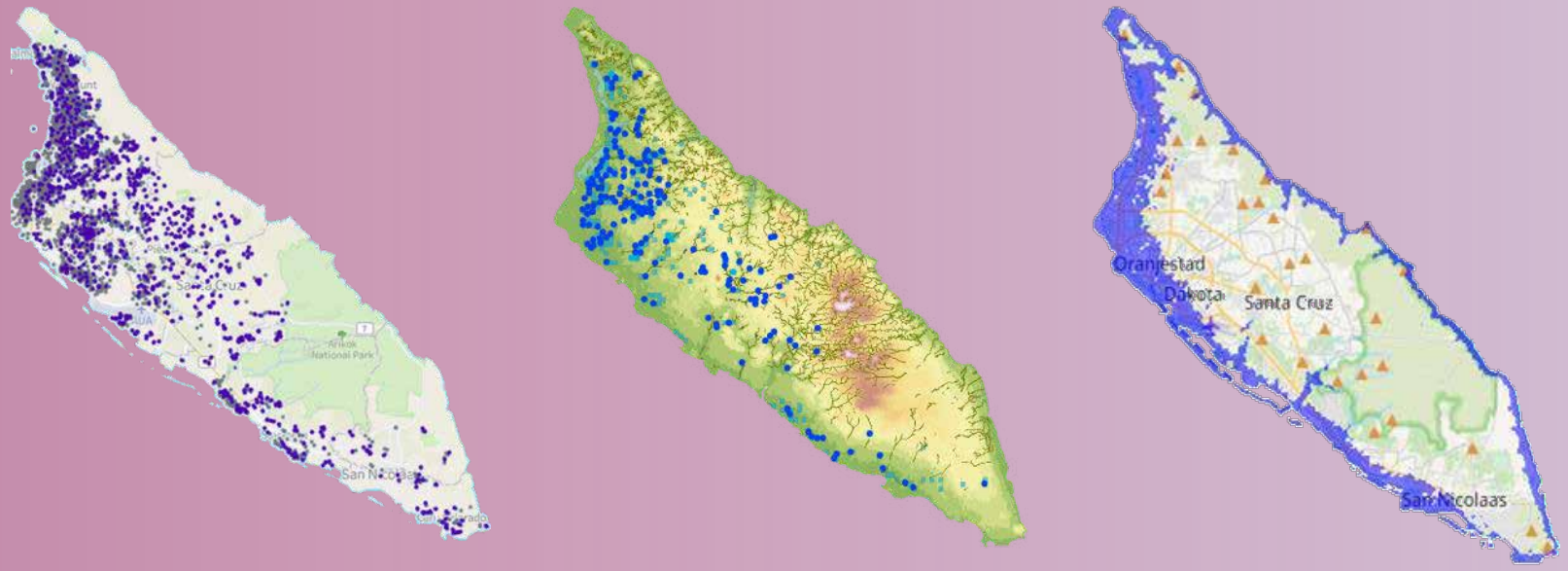


Figure 31. Stylized climate change risks and impact on housing and residential areas (Source: AirDNA, CBS, CBA; Author's calculation).

VII. ***In similar fashion, future research should delve into the domestic housing rental market to identify key developments and challenges in this specific housing market.*** Notwithstanding the relevant results of this study for purchasing and owning a house, the findings suggest that the (apartment) rental market (for residents) plays an important role in the current, and likely future, housing market, especially considering the ascent of VHR and STR properties.

VIII. ***Future research is required to examine the real and shared economic benefits of foreign real estate investment (FREI) and the shared contribution of the vacation home (VHR) market.*** Considering the growing economic contribution of the (foreign) real estate and the VHR tourism market, yet acknowledging the likely diminishing returns and (non-inclusive) benefits of FREI, i.e., a non-linear relationship between foreign residential real estate investment and real GDP growth over the past two decades, future research should scrutinize these findings by conducting comprehensive and robust analyses of concentration risks, transmission channels, and leakage costs of FREI and VHR markets.

IX. ***Future studies and reliable data are required to strengthen evidence-based housing policy development.*** Considering the growing disparity in, one the one hand, the total number of estimated VHR properties between public records (i.e., 2,300 in the ROPV) and market studies (i.e., 3,500 by VRPA; 5,100 by AirDNA,), in addition to the gap between registered residential housing units (i.e., CBS, 2021) and housing utility connections (i.e., WEB, 2021), and, consequently, the policy implications hereof for spatial planning, sustainable urban development, as well as zoning and business regulation, in addition to tax revenue collection and compliance (for the government), extensive field research and reliable data collection efforts are called for to measure and (continuously) monitor the (vacation) housing market.

In effect, in review of the aforementioned directions for future research on and policy development for affordable housing, the access to and availability of reliable data on (affordable) housing and related urban developments remain an enduring affordability Achilleas of the housing heel.

4.2. Policy implications and recommendations

Policymakers have a responsibility towards the future. Policymakers have the responsibility to shape more inclusive, resilient, and responsible housing systems and ensure that decent homes and neighborhoods are affordable, safe, and accessible, thereby implementing the SDGs by 2030, meeting the Paris Agreement climate goals, and realizing the Right to Adequate Housing in accordance with the Universal Declaration of Human Rights and International Covenant on Economic, Social and Cultural Rights (UN, 1991).

Despite challenges, progress can be made and accelerated with long-term political courage, commitment, and collaboration. In the spirit of Elinor Olstrom's 'Governing the commons' (Olstrom, 2015), and consistent with 'Governing from the Future – Leading with Impact' (CBA, 2022), governments can – and should – lead inclusive resilience by driving concerted policy actions to address and resolve mounting affordable housing concerns, supported by capable, ethical, and socially-responsible

entrepreneurs, as well as dedicated and informed civic advocates. However, these requisite structural policy shifts underscore the need for governing affordable housing in a systemic and systematic manner, duly recognizing that there are no 'quick fixes' or 'silver bullet solutions' to resolving affordable housing.

Taming the unaffordable housing tide and bolstering affordable housing supply – for current and next-gen households – requires a sustainable 'Aruban Urban Agenda' (AUA). Building forth the new Urban Agenda of the EU and based on the UN principles of affordable housing – inclusion, responsibility, and resilience –, the AUA agenda emphasizes (see Figure 32):

i. The need for political commitment, shared vision, integrated governance, and a comprehensive long-term national strategy for fostering affordable housing[43].
ii. The importance of managing both demand and supply forces in a balanced, context-sensitive, and responsible manner to foster affordable housing.
iii. The relevance of evidence-based, multi-stakeholder policy development, involving multiple layers and ministries of government, as well as dedicated partnerships with the private sector (including, e.g., monetary authority and financial institutions, as well as residential and vacation real estate agents, and tourism stakeholders).
iv. The requisite institutional capabilities and capacity, i.e., adequate financial and human resources, as well as expertise and skills to design and enable impactful policy actions for bolstering affordable housing.

From a ***demand perspective***, the aim is to manage housing demand, mitigate the risks of excessive (foreign) demand pressures, and generate the financial means and dedicated funding for stimulating and facilitating affordable housing (see Section 4.2.1). From a ***supply perspective***, dedicated financial and institutional are targeted toward, and focused on transforming affordable and inclusive housing in accordance with economic, fiscal, financial, and spatial-environmental regulations and directives (see Section 4.2.2).

More importantly, re-balancing and aligning housing demand and supply policy actions beget sound governance. Absent sound governance, the former decays due to market failures (i.e., negative externality) and institutional failures (i.e., policy drift). As evidenced in this study, affordable housing is dynamic and exposed to both foreign and domestic demand and supply forces. Furthermore, developing inclusive, responsive, and resilient housing cuts across several layers – traditionally siloed – of government, in addition to spanning the public sector, the private sector, and civic society (UN, 2021). The confluence of these dynamics and complexity calls for integrated and proactive governance, rather than a fragmented and reactive approach often observed and reported in previous studies. In essence, the growing deficit in affordable housing is oftentimes rooted in deficient modes and mechanisms for governing affordable housing.

[43] The design of an integrated governance model and a comprehensive long-term national strategy for affordable housing are beyond the scope of this study.

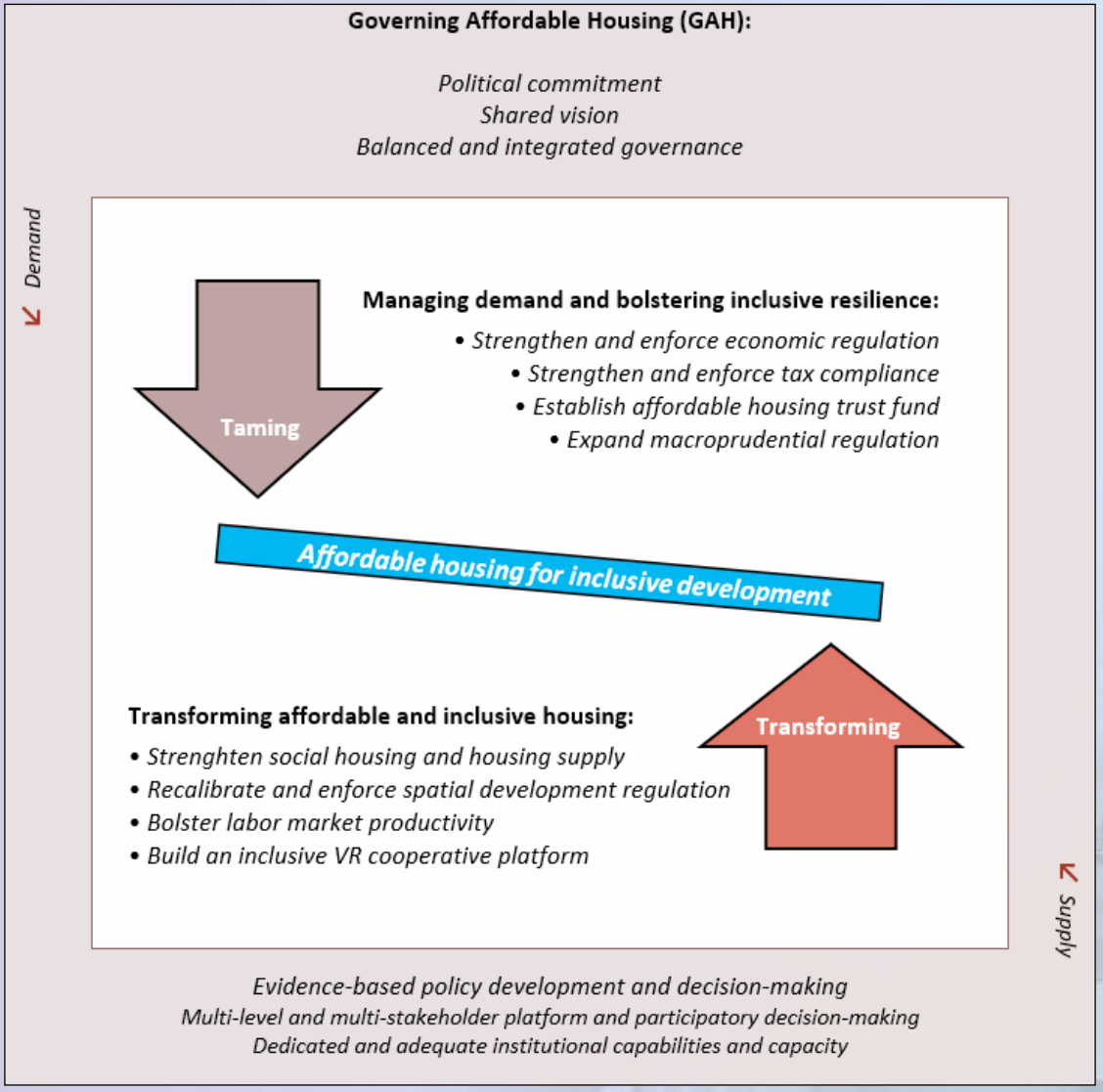


Figure 32. Framing the Aruban Urban Agenda 2040.

4.2.1. Managing demand and bolstering inclusive resilience

Demand policy measures cover economic, fiscal and financial policy recommendations to (see Table 8):

i. Strengthen and enforce economic regulation[44], including compliance with business licensing and zoning directives, as well as the use (and active maintenance) of an integrated VHR/STR digital registration system[45].
ii. Reform, enforce, and mobilize tax revenues that are subsequently targeted and earmarked.
iii. Establish an affordable housing trust fund (AHTF) as an independent 'affordable housing'-purpose institution to channel (tax and non-tax revenues[46]) dedicated funds towards affordable housing provision.
iv. Expand macroprudential regulation and formalize macroprudential policy instruments from a borrower (demand) perspective – Loan-to-Value (LTV), Loan-to-Income (LTI), Debt-to-Income, Debt Service-to-Income (DSTI) – for safeguarding financial stability and financial wellbeing of households.

Table 8. Demand policy recommendations for fostering affordable housing for inclusive development.

Demand policies	Policy measures and actions	Lead Authority	Potential estimate revenue generation
1. Economic regulation	1.1. Enforce business licensing for existing (unregistered) and new VHR properties. Target and support VHR tax mobilization and compliance program	Economic affairs, Tourism Finance	2022: Afl. 1.1 mln. (compliance of 2900 unregistered VHR properties[47] x Afl. 400,- license fee) 2024: increase VHR business license fee by Afl. 100,- (to Afl. 500,-) +2025: Afl. 25,000 (+50 VHR new properties per annum post-VHR moratorium (see 2.3.).
	1.2. Enforce regional zoning licensing for existing and new VHR properties	Economic affairs, Tourism, Infrastructure and Spatial Planning, Nature	2023: introduce a non-compliance fee or revocation of business license.
	1.3. Limit the amount of VHR/STR business licenses and regional zoning licenses for a period of at least two (2) years	Economic affairs, Tourism, Infrastructure and Spatial Planning, Nature	Introduce a temporary moratorium (2 years) on new VHR/STR properties in order to collect tax arrears and recalibrate spatial development regulations and directives, as well as manage the VHR tourism supply.

[44] Based on existing economic regulation and business licensing ordinance (DEACI, 2022).
[45] A shared distributed ledger (e.g., e-Government platform) for securely connecting different government departments (e.g., commerce, tax, infrastructure, etc.).
[46] For instance, 'Sustainable Housing Bonds' (UN, 2021).

Demand policies	Policy measures and actions	Lead Authority	Potential estimate revenue generation
2. Fiscal reform and regulation	2.1. Improve and strengthen (VHR) tax revenue collection and compliance from unregistered VHR properties (based on current tax regime) Target and support AHTF	Finance, Economic affairs	Leverage financing (Afl. 1.1 mln.) from business license revenues for (tax collection and compliance) capacity. Estimated potential tax revenue from VHR compliance improvement: Afl. 171.6 mln. Total estimate: Afl. 343.3 mln. (see Box 10 for stylized estimates).
	2.2. Increase the Transfer tax (TT) for non-residents by 4 percentage points (from 6 percent to 10 percent). Target and support AHTF	Finance Infrastructure and Spatial Planning	2023: Non-resident TT revenue: Afl. 25 mln. Total estimated TT: Afl. 50 mln.
	2.3. Increase Property tax (PT) by 0.4 percentage point (from 0.6 percent to 1 percent). Target and support AHTF	Finance Infrastructure and Spatial Planning	2023: Non-resident PT: Afl. 12 mln. Total estimated PT: Afl. 57 mln.
	2.4. Increase the special stay tax by $2,00 per night (from $3,00 to $5,00) for visitors and enforce for VHR/STR properties Target and support AHTF	Finance, Tourism	Additional special stay tax income from VHR market: Afl. 7.5 mln. Total estimate: Afl. 18.8 mln.
3. Affordable Housing Trust Fund (AHTF) and Aruba Housing Authority (AHA)	3.1. Establish an Affordable Housing Trust Fund (AHTF) as an independent 'affordable housing'-purpose institution to channel (tax and non-tax revenues) dedicated funds towards affordable housing provision (including social housing by the FCCA); Establish an Aruba Housing Authority (AHA) as an independent institution to oversee affordable housing development.	Finance, Economic Affairs,	Estimated required annual funds for affordable and inclusive housing: Afl. 175 mln. per year. Sources: Tax compliance, Tax reform, Bonds, Grants.
4. Macroprudential regulation and policy instruments	4.1. Introduce and formalize borrower-based macroprudential measures for monetary and non-monetary financial institutions, including commercial banks, mortgage banks, pension funds, and (life) insurance companies).	Centrale Bank van Aruba	Note: consider select exemptions for first-time homeowners to safeguard access to affordable housing for young(er) families and professionals (e.g., LTV = 85%)

[47] *Based on officially registered VHR properties by the Department of Infrastructure and Planning, Government of Aruba (DIP, 2020; ROPV, 2021).*

Box 10. Stylized impact of VHR tax compliance within current tax regime (Source: AirDNA, DIP, DIMP, CBA, Author's calculations)

Basic assumptions:

-VHR properties (2022e):	*5100*	*-Current VHR tax compliance rate[48]:*	*45%*
-VHR rooms:	*9,180*	*-Non-tax-compliance rate:*	*55%*
		-Maximum tax compliance rate:	*95%*
-Annual available room nights (95% maximum operational capacity):	*3,213,000*	*-Potential tax compliance income:*	*50%*
-Annual average occupied room nights:	*2,088,450*	*-Resident house ownership:*	*75%*
-Annual average occupancy rate:	*65%*	*-Non-resident house ownership:*	*25%*
-Annual average daily rate:	*Afl. 475*		
-Total estimate annual revenue:	*Afl. 992 mln.*		

	Rate and estimate total tax revenues (Afl. mln.)	***Potential tax revenue income (Afl. mln.)***
Tourism levy (9.5%)	94.2	47.1
Special stay tax ($3/night)	11.3	5.6
Subtotal	*105.5*	*52.7*
(Rental) Income tax (29%) [75% residents]	215.8	107.9
Profit tax (25%) [25% non-residents]	62	31
Property tax (0.6%)	6	3
Transfer tax (6%)	59.5	29.7
Subtotal	*343.3*	*171.6*
Total estimate*	***448***	***224***

**Excluding potential wage tax revenue income of an estimated 6000 employees in the formal and informal VHR labor market.*

4.2.2. Transforming affordable and inclusive housing supply

In tandem with demand policy measures, supply policy measures focus on transitioning to affordable housing and transforming inclusive housing supply by (see Table 9):

i. Strengthening social housing and housing supply (financially supported by earmarked tax revenues);
ii. Redesigning and enforcing spatial development regulation and directives (ROPV);
iii. Bolstering labor productivity by enforcing labor market regulation to reduce the informal labor force and increasing the minimum wage, in addition to strengthen educational opportunities and attainment levels, as well as workforce professionalization;
iv. Introducing an inclusive and socially responsible VR cooperative model.

It is estimated that the aforementioned supply policy measures and actions would require an approximated Afl. 200 mln. on an annual basis[49]. To contribute to resolving the affordable housing problematique in a sustainable and impactful manner, at least Afl. 2 billion would need to be invested in strengthening affordable housing, and required in dedicated funding and financing in the coming ten years (10) years.

[48] Based on the official number of registered VHR properties (2,300) by the Department of Infrastructure and Planning (DIP), Government of Aruba (DIP, 2020; ROPV, 2021).

[49] For covering the costs of social housing (Afl. 175 mln.), raising the minimum wage level (Afl. 10.2 mln.), and strengthening education and professionalization (Afl., 14 mln.).

Table 9. Supply policy recommendations for fostering affordable housing for inclusive development.

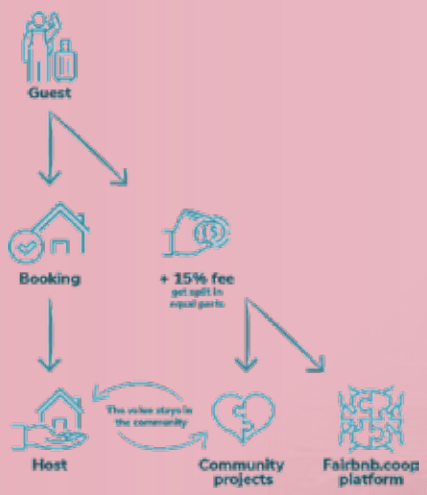
Supply policies	Policy measures and actions	Lead Authority	Estimated costs and required investments
1. Social housing	1.1. Expand the supply of social housing for meeting short-term and medium-term housing demand.	Social affairs, Infrastructure and Spatial Planning	Estimated costs: Afl. 175 mln.
	1.2. Bolster the transition to energy-efficient housing construction.	Infrastructure and Spatial Planning, Energy	
2.Spatial development	2.1. Reassess and recalibrate the spatial development plan and directives (i.e., the ROPV) to consider the current state and count of the VHR market and supply.	Infrastructure and Spatial Planning	
	2.2. Update and design new ROPV with amended directives considering results of recalibration.	Infrastructure and Spatial Planning, Nature	
	2.3. Enforce (pre-existing) spatial development regulation by restricting and controlling the further expansion of VHR properties in key zones (regions).	Economic Affairs, Tourism, Nature	
3. Labor productivity and education	3.1. Increase labor productivity by fomenting and incentivizing formal (registered) employment.	Labor, Integration	
	3.2. Close the income gap between the minimum wage and the subsistence level in the short-term.	Labor, Social Economic Council	Estimated costs: Afl. 10.2 mln.
	3.3. Reconsider the introduction of the high-income cap ('LNT') as this will have an adverse impact real GDP per capita development and disposable household income, consequently exacerbating housing affordability for middle-income households.	Economic Affairs, Finance	
	3.4. Strengthen educational opportunities and attainment levels, as well as workforce professionalization.	Education	Estimated costs: Afl. 14 mln.
	3.5. Limit and control low-skilled labor immigration and strengthen integration into formal labor force.	Integration, Justice	
4. Inclusive and socially responsible Vacation Rental cooperative model	1.1. Establish an inclusive VR platform (for VHR owners) 1.2. Introduce a $5 (per night) fee for supporting social housing and community programs. Target and support AHTF. (See Box 11 for stylized illustration of an inclusive VR cooperative model).	Vacation Rental Professionals of Aruba AHTF	Estimated revenue generation: Afl. 18.8 million

Box 11. Fairbnb (Source: Discover how Fairbnb.coop works | Fairbnb.coop - Community powered tourism).

Be the change where you live…

Promoting the idea to 'Be the Change where you live and where you go!', Fairbnb describes themselves as "a non-extractive alternative to the current vacation rental platforms". Created in 2016, the movement first started in Venice, Amsterdam, and Bologna, with other groups soon joining from all over Europe. In 2018, the co-op was created to serve as the legal entity behind the project, and the Fairbnb headquarters are now based in Bologna, Italy. Today, Fairbnb operates in over 20 countries.

Fairbnb is a community of activists, coders, researchers and designers that want to put the 'share' back into the sharing economy. Fairbnb.coop gives both travelers and locals the opportunity to participate in a more responsible and sustainable tourism model by supporting social and ecological projects for the local communities. The primary objective of Fairbnb is to keep the profits in the community. It gives the opportunity to stakeholders and community members to come together and collectively decide how the platform will be run in their neighborhood.



Fairbnb works with local governments to promote regulations that encourage regenerative and sustainable tourism. It is a community-centered alternative that prioritizes people over profit and facilitates authentic, sustainable, and intimate travel experiences while facilitating the development of socially impactful projects within communities'. According to Fairbnb:

"We work with local authorities to verify our hosts and with our Local Nodes to define sustainability rules to protect the community from the side effects of tourism. Our local communities define the social projects that are a priority for their sustainable development. We support them with the resources generated by tourism in the area. Like other platforms, Fairbnb.coop charges a commission. Unlike the others, it shares it with locals. This is what we call Community Powered Tourism."

4.2.3. Policy roadmap for governing affordable housing

To lead inclusive resilience and foster affordable housing for inclusive development, a structural – affordable housing – policy shift is quintessential. This structural policy shift underscores the need for governing affordable housing from the future in an integrated, transformative, and sustainable manner. To execute and realize the 'Aruban Urban Agenda' in accordance with the UNSDGs (i.e., SDG11), and building forth on principles of circular policy design[50], the following policy roadmap for governing affordable housing is proposed (see Figure 33).

Rather than follow a linear, fixed blueprint approach, the policy roadmap emphasizes a circular (non-linear), iterative, and resilient approach to bolstering affordable housing in the coming decade. Essentially, the policy roadmap covers four (4) basic phases of affordable housing policy development, including both demand as well as supply policy measures and actions. The four basic phases are: ***(I) Regulation and reform; (II) Funding and finance; (III) Transition and transform;*** and ***(IV) Assessment and adaptation.*** Each phase spans two (2) years and has an internal evaluative mechanism (feedback loop) to manage, monitor, and measure progress in the respective phase of policy development. Hereto, key policy performance indicators are used based on the previously identified policy measures and actions (see Table 8 and Table 9).

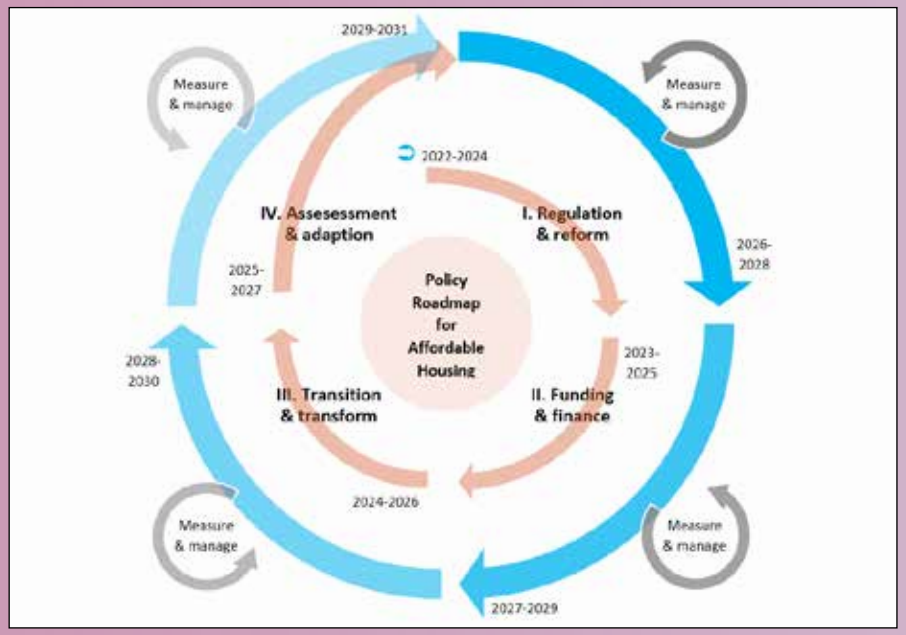


Figure 33. Policy Roadmap Affordable Housing.

[50] *Based on guiding principles and best practices in future design thinking, continuous improvement, agile design, and institutional adaptation and learning.*

The policy roadmap is built on a spiral design logic, in which the basic phases are interconnected in a circular (cyclical) manner. To strengthen affordable housing in a systemic and systematic manner, at least two (2) cycles are distinguished, i.e., a first inner cycle (2022 – 2027), followed by a second outer cycle (2026-2031). This 'double-loop' fosters an institutional learning process of capacity building, continuous improvement, and adaptation, particularly considering the complexity and dynamics[51] of affordable housing in small island economies. To conclude, the circular policy design emphasizes that fostering affordable housing for inclusive development is a long-run endeavor consisting of shorter-run policy actions that make a meaningful difference in the quality of life of households and families. Not only does affordable housing matter; it is the heart of the matter.

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[51] *Akin to the concept of VUCA environments, i.e., volatile, uncertain, complex, and ambiguous.*

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