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SISSTEM: Academic STEM Programme as Change Agent for Sustainable Development on the Small Island State of Aruba

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Abstract

Academic university programmes educate the future generations of highly-skilled people in our society, thereby having the potential to act as change agents for sustainable development within their region. The SISSTEM – Sustainable Island Solutions through Science, Technology, Engineering and Mathematics – is an academic programme currently being deployed at the University of Aruba in partnership with KU Leuven, Belgium. It aims to educate a new generation of engineers and scientists, policy makers and entrepreneurs who have a profound knowledge of STEM subjects in a sustainability context, and who can apply this knowledge in the particular setting of a small island state (SIS) like Aruba. This allows to further strengthen

the island's sustainable growth and development. In this chapter we evaluate whether the SISSTEM programme does indeed have the potential to be a change agent for sustainable development on Aruba. The evaluation is based on five critical factors, namely the consideration of dominant sustainability challenges in the region, the financing structure and independence, the institutional organization, the democratic processes and the communication and interaction with society. We conclude that the programme has significant potential of becoming a critical change agent in Aruba, the Caribbean and potentially other SIS. The approach of the SISSTEM programme described here can be of interest to other higher education institutes around the globe that aim at developing new or improving existing curricula in order to become change agents for sustainability.

Introduction

On the September 2, 2019, thirteen Aruban students began a new chapter in their lives and started their education in Science, Technology, Engineering and Mathematics (STEM) at the University of Aruba (UA). In other countries, such an event might have passed unnoticed. However, not in Aruba, as those students are the first to follow a STEM bachelor programme on the island itself. The Sustainable Island Solutions through STEM (SISSTEM) programme currently being deployed¹ by the University of Aruba in partnership with the University of Leuven (KU Leuven), Belgium, aims to educate locally a new generation of engineers and scientists, policy makers and entrepreneurs. It seeks to develop graduates with a profound knowledge of STEM subjects in a sustainability context and, who at the same time, can apply

¹ The program started with the first bachelor year in Fall 2019.

this knowledge in the particular setting of a small island state (SIS) like Aruba. The ultimate goal is to further strengthen the country's sustainable growth and development beyond today's main source of income, that being tourism.

General Characteristics of Small Island States

Before detailing the SISSTEM program, it is essential to outline the particular setting of a SIS, like Aruba. SIS are defined by the World Bank as islands states with a population of 1.5 million or fewer (World Bank, 2020). Due to their specific geographical context, they come with a collection of distinct characteristics that together make them complex entities. Many authors have discussed these distinct characteristics, e.g. Briguglio (1995), UN-OHRLLS (2009) and UNEP (2014). SIS are characterized by their small size, remoteness and insularity (Briguglio, 1995; UN-OHRLLS, 2009; Gomes, 2014; Connell and Lowitt, 2020). As a direct consequence of their small size, natural resources, including land area (Gomes, 2014; Connell and Lowitt, 2020), are available in a limited way (Briguglio, 1995; Kerr, 2005; UN-OHRLLS, 2009). This results in a high competition for land use among the different needs of the population living on these islands, such as housing and infrastructure, agriculture, recreation and nature, etc. (UNEP, 2014). At the same time, unique biodiversity and ecosystems can often be found on SIS, including coral reefs and mangroves (UN-OHRLLS, 2009), which are under pressure due to land competition and other human influences (UNEP, 2014). Additionally, these unique ecosystems are usually very fragile (Gomes, 2014), and are characterized by tight feedback loops between the environmental stressors, such as cyclones and human influences, and their impacts (Kerr, 2005). The vulnerability of SIS' ecosystems and biodiversity is further increased by climate change (Briguglio, 1995; Kerr, 2005; UN-OHRLLS, 2009; Gomes, 2014; Connell and Lowitt, 2020). Indeed, SIS, being faced with "more extreme weather events, sea level rise, stressed water

resources due to changes in rainfall patterns, intermittent droughts and acidification of the oceans”, are considered to be among the places which are the most susceptible to the impacts of climate change (Connell and Lowitt, 2020, p. 3).

Given their small size, SIS cannot profit from economies of scale (Briguglio, 1995; Kerr, 2005; UN-OHRLLS, 2009; Guillaumont, 2010; Gomes, 2014; CBA, 2019; Connell and Lowitt, 2020), and are characterized by an easily saturated internal market (Briguglio, 1995; Gomes, 2014; Connell and Lowitt, 2020), and limited internal market competition (Briguglio, 1995; Connell and Lowitt, 2020). Their remoteness and smallness lead to large transaction costs when trading, as well as limited negotiation power. Further, these features also lead to high costs related to transportation, (Briguglio, 1995; Kerr, 2005; UN-OHRLLS, 2009; Gomes, 2014; Connell and Lowitt, 2020), communication and energy (UN-OHRLLS, 2009; Gomes, 2014; Connell and Lowitt, 2020). Indeed, while the costs of infrastructure and installation are expensive, like in any other country, these costs can only be divided across a limited tax base (Kerr, 2005; Connell and Lowitt, 2020). The same is true for public administration (Briguglio, 1995; Kerr, 2005; UN-OHRLLS, 2009; Guillaumont, 2010; Gomes, 2014), which according to Connell and Lowitt (2020) is disproportionately expensive.

It comes as no surprise then that the combination of the challenges described makes SIS economically vulnerable to external shocks (Briguglio, 1995; Gomes, 2014). Economic vulnerability in this context has been defined by Briguglio *et al.* (2009) as “the exposure of an economy to exogenous shocks, arising out of economic openness” (Briguglio *et al.*, 2009, p. 229). On the other hand, while it is widely acknowledged that SIS are highly economically vulnerable, it is generally agreed that their economic resilience is relatively high (Briguglio *et al.*, 2009). Economic resilience is defined by Briguglio *et al.* (2009) as “the policy-induced

ability of an economy to withstand or recover from the effects of such shocks” (Briguglio *et al.*, 2009, p. 229). Measures to increase economic resilience, for example in Aruba, are to diversify the economy, to rethink and redesign the educational systems and values, targeting more highly-skilled work and seeking to “identify, integrate, and incubate 21st century innovation skills in their programs” (CBA, 2019, p. 74).

Aruba: A Small Island State in the Caribbean

Aruba is a small island of about 180 km² (Derix, 2016) with about 112,000 inhabitants (CBS Aruba, 2020). With more than one million stay-over tourists, and over 800,000 incoming cruise ship passengers per year (CBS Aruba, 2015; APA Aruba, 2019), Aruba’s economy is hugely dependent on tourism. Indeed, it has been estimated that 87% of the Aruban economy depends directly or indirectly on tourism (IMF, 2019; Peterson, 2020). This enormous dependency on tourism makes Aruba the most vulnerable small open economy in the region, resulting in a larger volatility in its economic growth compared to the region and the world economy (CBA, 2019; IMF, 2021). While tourism generates employment and revenues, it also has a profound impact on Aruba’s environment and ecosystem. Besides the impacts of tourism, Aruba faces other sustainability challenges (outlined below in ‘Results’).

The need to diversify the economy and to make it less dependent on tourism and, at the same time, more focused on long-term sustainable development has been acknowledged by local policy makers (CBA, 2019). This need has become more prominent under the current Covid-19 pandemic, which fully revealed the vulnerability of the Aruban economy (IMF, 2021). At the same time, Aruba has identified a need for highly-skilled people that can contribute to its longer-

term sustainable growth and development. This need is acknowledged by the private sector in Aruba, looking for a labour force with knowledge in STEM to support projects related to biotechnologies, renewable resources like energy and water, waste management, adaptation and mitigation to climate change, among others. Indeed, in Aruba, the largest growth in the labour market occurs in sectors that require relatively highly-skilled labour (Hermans and Kösters, 2019). Until recently, the absence in Aruba of higher education in STEM made the island completely dependent on external education, expertise and consultancy, leading to a brain drain of young talent, high financial costs and a lack of a sustainable knowledge base on the island itself.

Background on the SISSTEM Programme

Given these specific characteristics of Aruba, which are very similar to other SIS, state-of-the-art knowledge of technological solutions embedded in the local context is key to further sustainable development and the increased resilience of Aruba. In this context education is essential and in SIS particularly, Education for Sustainable Development (ESD), provided by local higher education institutes, has a vital role to play. Indeed, ESD explicitly recognizes the need to educate students not only with state-of-the-art knowledge, but to equip them with skills and competences enabling them to apply the acquired knowledge within a specific context, such as a SIS, to support sustainable development. These skills and competences include systems thinking, critical thinking, normative competence, collaboration and self-awareness (Kioupi and Voulvoulis, 2019). As such, through ESD applied in local higher education institutions, the next generations of highly-skilled workers can be formed, thereby acting as agents of change to enhance sustainable development (Stephens *et al.*, 2008; Eppinga, de Scisciolo and Mijts, 2019).

Today, however, SIS often have limited availability of education programs, researchers and research funds to support ESD in STEM fields.

The SISSTEM project aims to provide an answer to this need by setting up an academic education and research programme at the University of Aruba to educate local and regional youth in STEM, thereby focusing on sustainability issues in SIS. The SISSTEM programme was kick-started by the SISSTEM project, funded under the 11th European Development Fund for Overseas Countries and Territories (EDF-OCT). The project is a collaboration between the University of Aruba, DEACI (Department of Economic Affairs, Commerce and Industry of Aruba), UNDP (United Nations Development Program) and KU Leuven². As shown in Figure 1, the goal of the SISSTEM project at UA is to set up an academic bachelors and a masters programme in STEM and to develop the necessary infrastructure, including classrooms and laboratories, while at the same time building up a research program in sustainability research.

² The oldest and largest university in Belgium, based in Leuven, founded in 1425, and today one of the world's leading universities in innovation, being the most innovative university in Europe and ranking 7th in World according to Reuter World's Most Innovative Universities list in 2019 (Ewalt, 2019).

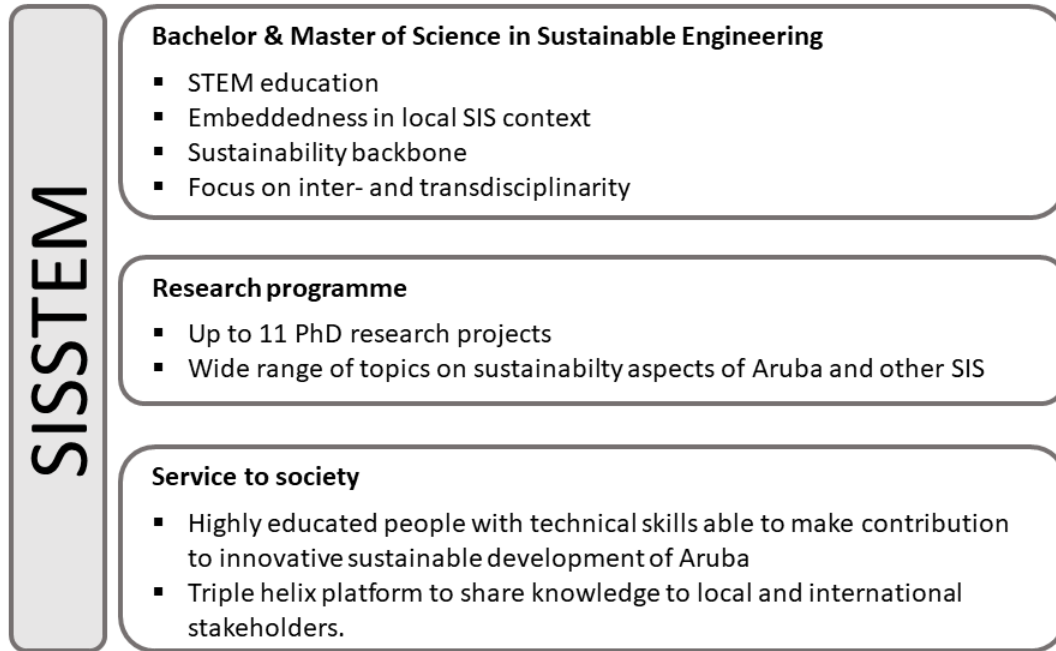


Figure 1: Overview of the different components of the UA-KU Leuven SISSTEM project, source: own depiction.

The new bachelor educational programme started in Fall 2019 and is supported by a team of four senior lecturers at the UA, with contributions from around 25 KU Leuven professors, who support the UA senior lecturers in developing their course materials. Furthermore, KU Leuven and the UA work together to develop up to six MOOCs (Massive Open Online Courses) and SPOCs (Small Private Online Courses), that can both be used in the SISSTEM bachelor programme at UA as well as at KU Leuven. As such, a ‘win-win’ situation is created. The bachelor programme offers three specialization tracks: 1) bio-environmental sciences; 2) informatics and data sciences; and 3) technology and engineering. In 2022, the subsequent multidisciplinary master programme, that is currently under development, will begin.

Additionally, up to eleven PhD projects³ are underway in the SISSTEM project with research on a wide range of topics relevant to the further sustainable development of Aruba in particular, and SIS in general. The PhD candidates follow their doctoral training program at KU Leuven and are supervised by a KU Leuven promoter as well as by the Aruban academics. They spend one semester per year in the research group of the KU Leuven promotor to ensure academic training and research in their specific domain. As such, there is a reciprocal link between the UA and KU Leuven. Besides their research, the PhD candidates also assist in teaching tasks in the bachelor program at the UA.

Finally, the SISSTEM programme focusses on service to society. Indeed, the goal is to deliver highly educated people with the technical skills to contribute to the innovative sustainable development of Aruba. A triple-helix platform is developed, where STEM knowledge and research at the UA are linked to local and international parties. As such, businesses, institutes, governments and NGOs can exchange their knowledge, experiences and resources with the SISSTEM program, in order to develop and support sustainable practices in Aruba and other SIS.

Given all these intentions and goals, the question now arises whether this SISSTEM programme will effectively reach its targeted objectives and if it has the potential to change the current trends described above and to really be a local and regional agent of change.

³ At the moment of writing 10 out of 11 PhD students have been recruited.

Goal of the Chapter

In this chapter, we evaluate whether the SISSTEM programme has the potential to be an agent of change for sustainable development in Aruba and by extension other SIS. Although the SISSTEM project has some specific characteristics, this study intends to inspire and motivate other higher education institutions in SIS around the globe that aim to develop new or enhance existing curricula in order to become change agents for sustainability. As such, this chapter moves beyond describing the SISSTEM-specific challenges, and presents our views on lessons learned and best practices.

The chapter is organized as follows. In the next section, we present the framework for evaluating the SISSTEM programme based on Stephens *et al.* (2008) as well as the qualitative research methods used. Following this, we present the results of this research analysis, and evaluate the SISSTEM program based on the five critical factors identified by Stephens *et al.* (2008). We then discuss whether the SISSTEM program can indeed be an agent of change for sustainable development in Aruba before presenting our main conclusions in the final section.

Methodology

Framework

Stephens *et al.* (2008) identified five critical factors that are needed for higher education to be able to function as an agent of change. In this chapter, we use these five critical factors as a framework to evaluate the SISSTEM program:

1. The dominant sustainability challenges of the region: here the programme is evaluated as to what extent it takes into account the local sustainability challenges of the country or region where the programme takes place.
2. The financing structure and independence: here the programme is evaluated based on its financing. Where do the main finances come from? Can these finances support the programme in the mid and long term? Should private sources of funding be added, and might this private funding jeopardize the programme's independence?
3. The institutional organization: here the programme is evaluated as to what extent the curriculum is discipline-specific or rather more inter- and transdisciplinary organized, including outreach to and involvement of non-academic organizations in the curriculum and course development.
4. The extent of the democratic processes: here an evaluation of the programme is made as to what extent it is accessible to all members of society, as well as its transparency and neutrality.
5. Communication and interaction with society: here the programme is evaluated as to what extent the research results and other outputs are communicated both within academia as well as to the broader stakeholders in the local and regional society.

In the following sections, we evaluate the SISSTEM program based on these five critical factors.

It is important to note that by applying this framework, we aim to evaluate the potential of

SISSTEM to be an agent of change for sustainable development, as it is too soon at this stage¹ to evaluate the programme's impacts on Aruban society.

The evaluation of the SISSTEM program is based on the following data sources:

1. The 11th EDF Territorial Program for Aruba – FED/2018/41657;
2. The Grant Contract between the European Union, KU Leuven and the University of Aruba - FED/2019/406-549, including all annexes;
3. The SISSTEM Study Guide, describing the SISSTEM curriculum;
4. Semi-structured interviews with SISSTEM stakeholders (Section 2.2).

Semi-structured Interviews with SISSTEM Stakeholders

In order to get a thorough understanding of the SISSTEM programme, its functioning and potential as an agent of change in the Aruban society, in addition to studying the underlying documentation of the programme we conducted semi-structured interviews with its different stakeholders. To steer the semi-structured interviews, we used interview guides that were scheduled following a general script and covering a list of topics that needed to be addressed. This general script is presented in Appendix 1. The interview guide ensured that no topics were omitted but allowed the possibility for following new leads or changing the topic if deemed necessary (Bernard, 2006). During the research process, the data were directly interpreted, and further data collection was based on the previously collected knowledge. Semi-structured interviews are a useful way to acquire a large quantity of information in a limited amount of time, especially when respondents can typically only be approached once and no follow-up questions can be asked later on (Bernard, 2006). They provide the researchers with empirical

knowledge and a level of understanding that often cannot be acquired through literature study alone. The interviews contributed to understanding the daily functioning of the SISSTEM programme, its successes and its challenges, and allowed us to verify (using the framework provided by Stephens *et al.*, 2008) whether or not SISSTEM has the potential to act as an agent of change for Aruban society. Indeed, this qualitative research method allows us to cross-check the original purposes of the SISSTEM programme as described in the project documentation through triangulation (Koehn and Uitto, 2014).

Respondents for the interviews were selected via purposive sampling and snowball sampling (Bernard, 2006). The first respondents were identified based on their role in or involvement with the SISSTEM program (purposive sampling). Next, these respondents were asked for names of other stakeholders (snowball sampling). When the point of saturation had been reached (Morse, 1991; Bernard, 2006), the interview round was ended. In total 30 semi-structured interviews were conducted. Table 1 gives an overview of the types of respondents and the interviews conducted. Due to the Covid-19 pandemic, all interviews were conducted online. We recorded and transcribed all interviews and organized and analysed them in NVIVO 12.

Table 1: Overview of semi-structured interviews conducted

Type of respondent	Number of respondents
SISSTEM Steering Committee members	5
SISSTEM staff members at the UA	11
KU Leuven staff members	10
Stakeholders wider Aruban society	4
Total	30

Results

In this section, we evaluate the SISSTEM programme as to what extent it addresses the five critical factors identified by Stephens *et al.* (2008).

SISSTEM and the Dominant Sustainability Challenges of Aruba and Other SIS

In this section, the programme was evaluated as to what extent it takes into account the local sustainability challenges of its country or region. We first discuss how the respondents perceive the sustainability challenges in Aruba. Next, we discuss how the SISSTEM program takes these sustainability challenges into account, both in its research and in the bachelor educational programme.

Dominant sustainability challenges in Aruba as perceived by the respondents

During the interviews, respondents discussed what they considered to be the most important sustainability challenges of Aruba. The most prevalent challenges brought up by the respondents were the issues related to waste management and to the availability of fresh water, food and energy.

Regarding waste, respondents indicated that until recently most waste was landfilled without any further processing. This led to the landfill overflowing in the ocean and to regular landfill fires. Nowadays, part of the waste is rudimentarily separated, and residual waste is shredded, processed and wrapped in plastic and buried (Weekes, Mijts and van Caneghem, 2021). Respondents noted that previous initiatives like the construction of a local waste processing facility and a pyrolysis installation has led to a large loss of invested capital, as they have been rarely operational. At the time of writing, there are talks about transporting the Aruban waste to Colombia to be burnt in a cement factory.

The limited availability of fresh water on the island forces the Arubans to produce most of their fresh water themselves via an energy-intensive reverse osmosis process. Aruba has an average rainfall of about 450 mm a year (Shah, 2021) but with a high run-off and limited absorption into the ground. Rainwater collection could contribute to the availability of fresh water but is only limitedly applied. Both the limited freshwater availability and the limited arable land availability hamper local food production. While there is some local production of leafy greens and some home gardening, Aruba's agricultural sector is very small⁴ and almost all food is imported. As such, increasing food security, producing more local food and becoming less dependent on food imports, was mentioned by some respondents as a key focus area for further sustainable development of the island. New and modern technologies, such as vertical farming, could provide solutions to local food production (Shah, 2021).

For its energy production, Aruba is largely dependent on the importation of fossil fuels (IMF, 2019). About 20% of Aruba's total energy capacity comes from renewable energy sources,

⁴ Accounting for less than 5% of the country's GDP according to (CBA, 2019) and creating even no added value according to (World Bank, 2021)

mostly wind and to a lesser extent solar (CBA, 2019). In this context, Aruba likes to promote itself as a testing ground for renewable energy technologies. However, renewable energy production comes with its challenges. Continuous and strong fluctuations in wind and solar energy production are inherent, while the stability of the grid needs to be assured with no options to import or export energy from outside, as is the case in a more continental setting. As one respondent stated:

The wind blows on the entire island or it does not, the sun shines on the entire island or it does not. As such, the energy spikes are completely different.

[KU Leuven staff member]

To a lesser extent, respondents also mentioned environmental pressures such as the increased urbanization and population density, degradation of the marine environment and the limited terrestrial biodiversity, next to more socio-economic issues including the health system and the prevalence of obesity, social inequality, poverty and immigration issues.

According to the respondents, all the above-mentioned challenges are intensified by Aruba's enormous dependence on the tourism and hospitality sector. As previously noted, it has been estimated that 87% of the Aruban economy depends directly or indirectly on tourism (IMF, 2019; Peterson, 2020). While tourism generates employment and revenues, it also has a profound negative impact on Aruba's environment and ecosystem. For example, it has been estimated that 20% of the energy produced on the island is consumed by the tourism and hospitality sector (CBA, 2019). Additionally, food imports are not only needed for the local residents, but also for

the tourists. The packaged and processed food and consumables imports lead to even larger waste volumes. According to the respondents, the increased urbanization rate can almost entirely be attributed to the construction of hotels, apartments, bungalows and other facilities for tourists, or the construction of houses for the immigrant tourism-related work force. Furthermore, respondents stated that because the hotels are mostly located along the shores, they impact the marine environment as they cut off coastline interaction between the marine and terrestrial environment; this is also confirmed by literature (UN-OHRLLS, 2009; de Scisciolo *et al.*, 2016). Additionally, with over 800,000 incoming cruise ship passengers per year (CBS Aruba, 2015; APA Aruba, 2019), dredging and other activities related to these cruise ships are putting significant pressure on the marine environment.

Sustainability Challenges Taken into Account in SISSTEM Research

Respondents mentioned the urgent need for sound decision making in Aruba, based on data and research, to address the sustainability challenges. However, many respondents mentioned the lack of data and/or its accessibility to confirm potential links between activities taking place on the island and sustainability challenges. As one respondent stated:

Aruba is really data deficient in many areas, but certainly on nature and environmental areas. So, it's just completely missing, we don't have baseline studies or minimal baseline studies. [Stakeholder wider Aruban society]

As such, it is essential to start acquiring data on all the sustainability challenges raised to support sound evidence-based decision making. The research component in SISSTEM significantly responds to this need, as there are up to eleven PhD research projects, each aiming to address one or more of these challenges. Table 2 presents an overview of the SISSTEM PhD research projects.

Table 2: Topics of the 11 PhD research projects in the SISSTEM programme

Nr.	PhD research subjects of SISSTEM PhD students
1	Sustainable agriculture in SIS: vertical farming
2	Development of an optimized sustainable waste management system for Aruba
3	Connectivity between marine fish populations – Research in support of the sustainable management of marine ecosystems
4	Engineering sustainability ... or sustainable engineering. Research project on the edge of sustainability, engineering, entrepreneurship, and education in Aruba
5	Comparative research on social innovation and just resilience in the governance of small insular socio-ecological systems
6	Detection and spatial analysis of urbanization and land use change in SIS, by means of GIS and remote sensing techniques
7	Internet of Things for elderly care in Aruba
8	Operation of reverse osmosis and valorisation of brines under conditions of variable productivity: using the ocean as a sustainable resource
9	Life cycle analysis for a more sustainable agri-food chain on Aruba

- 10 Thermal heating or drying system on solar energy / Thermal valorisation of indigenous fuels
 - 11 Organic chemistry for valorisation of natural resources
-

Incorporating Islandness in SISSTEM Research

Often respondents stated that the sustainability challenges of Aruba should not be seen as stand-alone elements, but that there is need to put these challenges in the specific context of Aruba, namely the fact that Aruba is a small island state.

As Aruba only has a surface of 180 km², all the sustainability challenges take place in a very limited area within an isolated fragile ecosystem, with no option for diffusion of the hazards to a wider area. As such, these issues and their impact are magnified. Additionally, stakeholders indicated that Aruba, like other SIS, lacks sufficient trained people in governance, economics, science and technology, which are essential skills for the sustainable development of a country. According to the respondents, as a result, foreign consultants are often called upon to solve problems that need technological and other know-how. However, these consultants are often not familiar with the local island context, leading to sub-optimal or unsustainable solutions. One respondent explained it as follows:

Most islands then end up importing some other people with the curiosity and the technical drive to come up with solutions locally, which I see in the beginning struggle. It takes longer to move forward, because these people come in with different ideas from outside. But without knowing the context.

[SISSTEM staff member at the UA]

In order to account for these specific island challenges, respondents indicated that the SISSTEM programme not only aims to take these specific challenges explicitly into account, but also that this fact was one of the drivers for many SISSTEM staff members and KU Leuven staff members to participate to the project. Specifically, SISSTEM staff members have been selected in such a way that they are all anchored in the Caribbean or have a connection with SIS. Additionally, respondents stated multiple times that the research conducted always has a specific focus on finding tailored solutions for the sustainability challenges of Aruba and by extension of other SIS. As one respondent indicated:

So in this case it is the development of knowledge, from a local context and no longer the translation of western methodologies and the like. No, we are going to see what the situation is here and how we can change it. What can we do to contribute to helping the Aruban community first but also the rest of the Caribbean?

[SISSTEM staff member at the UA]

The requirement of locally-anchored staff members has large advantages, as they are already aware of the specific challenges. On the other hand, respondents also indicated that – particularly due to this requirement – finding suitable staff members has been more difficult than originally anticipated and extra efforts were needed to attract candidates to the remaining open functions. Additionally, respondents mentioned that keeping this insular focus in both research and

education is not always easy, and requires a certain flexibility and patience, especially for KU Leuven staff members used to working in a western continental setting, which differs from the SIS' context as explained in in the chapter's introduction.

Sustainability Challenges Taken into Account in SISSTEM Education

The course is based on a course from KU Leuven, but I am giving it a local spin.

[SISSTEM staff member at the UA]

With regards to the SISSTEM bachelor programme, many courses taught are based on courses originally developed at KU Leuven. Therefore, most of these courses make use of Belgian or European examples and are framed in a continental setting. Both SISSTEM as well as KU Leuven staff members recognize the need to adapt these courses to the local context and the sustainability challenges in Aruba. Local SISSTEM lecturers indicated that instead of using European examples, they use Aruban examples, or they prioritize emphasis on challenges that are more prevalent in SIS. In addition, some courses (see Table 3) are specifically focused on the challenges of SIS.

Table 3: Overview of SISSTEM courses specifically focused on SIS' challenges

Course name	Course objective
Principles of Sustainability and Sustainable Development Goals	Understand SIS challenges and to understand sustainable development for SIS

Integrative Project in Sustainable Development	Integrate knowledge on sustainable development and apply it to the analysis of contemporary problems faced by SIS in the Caribbean
Interdisciplinary and Multidisciplinary Approaches to Sustainable Development	Conduct research on specific sustainability challenges related to SIS
Entrepreneurship, Innovation and Society	Capita selecta course in which a wide variety of speakers from within and outside Aruba are giving seminars on how they perceive entrepreneurship, innovation and society within a SIS context

Respondents from both universities indicated that the adaptation of KU Leuven course content to the local situation was difficult for some more fundamental STEM courses, such as mathematics, chemistry and physics. Additionally, some KU Leuven staff members indicated that for them it was challenging to adopt the course content to the sustainability challenges of Aruba, as they do not know the local context and challenges very well. Therefore, the work of the local lecturers in providing this local context to the courses cannot be underestimated. Local lecturers, however, also indicated that, while they made serious attempts to integrate the local sustainability challenges, this also takes time and therefore at this moment, the full potential has not yet been reached. The level of depth of the courses also has to be finetuned to the knowledge level of the local incoming students. As one respondent stated:

So, probably when the lecturing is in cruise control and I have a bit more time, we can see “okay, which exercises and experiments we can facilitate more of the Aruba field”. In anyway, I am hopeful, when we have proper manpower on board, hopefully we can be able to do an awful lot more, and adapt the program a lot more to the Aruban society.

[SISSTEM staff member at the UA]

SISSTEM: Financing Structure and Independence

In this section, we evaluate the financing structure of the SISSTEM programme. Where do the main finances come from? Can these finances support the programme in the mid-long and long term? Should private sources of funding be added, and might this private funding jeopardize the program’s independence?

Short-term financing as kick start for the SISSTEM program

So if we hadn't had that initial funding, then I don't know how we could ever have made this successful.

[SISSTEM staff member at the UA]

Currently, the SISSTEM programme is financed as a project under the 11th EDF-OCT European funding. The goal of the funding is merely to kick-start the program, over a period where the curriculum and course contents are being developed and optimized and the necessary infrastructure, including classrooms and laboratories, is being constructed. Some respondents indicated that for them the initial funding by the EU was very important, because it generated trust in the new programme, and allowed for a partnership between the UA and KU Leuven that probably would not have been possible to the same extent without the funding. Respondents also indicated that because the programme is now externally financed, and not directly by Aruban public funds, this will allow it to grow first and become established. When the EU financing stops, respondents expect that the programme will have gained a sufficient base to have moved out of the political debate and to get recognition and government financing just like any other educational program at the UA.

Long-term financing

If the financing of the project stops, they will have to be able to continue using their own resources.

[KU Leuven staff member]

Many respondents raised concerns about the long-term financial sustainability of the programme. In the long term, the SISSTEM program will mainly be financed by the Government of Aruba, as has been agreed upon before the start of the project, and by the tuition fees paid by local and foreign students. It has been estimated that a total of thirty students per year is needed to make

the delivery of the programme financially feasible. To reach this objective, respondents indicated that extra efforts are needed to attract students from other islands in the region. Hampered by the Covid-19 pandemic, actual visits to other islands to recruit students are impossible at this stage. Therefore, at the time of writing, a social media campaign was run to attract foreign students to the programme. The ability to attract sufficient students and funding for the programme in the long term is one of the main risks to the long-term sustainability of the programme identified by the stakeholders.

Additionally, new research projects will require new applications for funding, for example with the regional and local government organizations, funding agencies and companies and in addition with the EU, Dutch NWO⁵ calls, or through collaborations with other universities. Furthermore, the SISSTEM research program should be able to assist the Aruban Government in conducting research projects on the implementation of the SDGs, in return for extra research funding.

Independence in education and research

None of the respondents raised worries about the risk that certain financing structures would jeopardize the independence of the bachelor programme. If respondents commented on this, they were informed that while the government has a large say in the programmes that are run at the UA as they fund these programmes for almost 90%, they do not interfere with the content of programmes and leave final decision making on programme content with the UA itself.

⁵ *Nederlandse organisatie voor Wetenschappelijk Onderzoek* (Dutch Organization for Scientific Research)

However, there was a bit more hesitation on the full independence of the research. While in principle all research topics can be freely investigated, respondents indicated that they fear that certain research results will not be fully accepted and/or respected by the Aruban society when they do not fully match the local expectations. Further, some respondents also mentioned that the research may face difficulties in getting cooperation and support from some stakeholders involved in getting the data needed to conduct the research. We elaborate further on this later in the chapter. Nevertheless, in general, it seems that independence of both education and research is guaranteed.

SISSTEM's Institutional Organization

I think compartmentalization is always a bit of a threat to the role you can play anyway. Our scale simply does not allow this compartmentalization to persist. This compartmentalization is only possible as long as you bring people back together. If, for us, this compartmentalization actually means that each entity is not sustainable in itself, then you are not offering solutions, but you are actually creating a reduction that can never pay off. In addition, it is also true that I believe that the complexity of sustainability issues in small island states, those are issues that are political, legal, technical, social, that encompass all that.

[SISSTEM Steering Committee member]

The majority of the universities around the world, including the UA and KU Leuven, are structured according to traditional disciplines (Stephens *et al.*, 2008). However, within the

SISSTEM programme, four different KU Leuven faculties from the Science, Engineering and Technology Group are collaborating now in an interdisciplinary way. Additionally, the SISSTEM programme is designed such that, besides the students taking fundamental STEM courses like mathematics, physics, chemistry or biology, the programme has a strong interdisciplinary and transdisciplinary focus. At the same time, it is an engineering programme, focusing on problem solving and on applied rather than basic science, oriented towards sustainable engineering. In this respect, respondents who initialized the program indicated that it always was their goal not to develop a plain copy of existing STEM programmes, but to tailor it to the local context. This was also recognized by many of the other respondents, who indicated that they considered the SISSTEM programme to be unique in this way.

Indeed, besides traditional STEM courses, the courses presented in Table 3 aim to teach the students the skills needed to combine and integrate what they have learned in the different STEM courses and apply it to actual sustainability challenges within Aruba and other SIS. In this way, the programme equips them not only with knowledge, but also with the skills to operationalize this knowledge when confronted with the local sustainability challenges. These skills and competences include systems thinking, critical thinking, collaboration and self-awareness, ownership and responsibility (Kioupi and Voulvoulis, 2019). In this sense, the SISSTEM programme follows the principles of Education for Sustainable Development (ESD).

Table 4 lists the different courses in the SISSTEM bachelor program and subdivides them into ‘Traditional STEM courses’, ‘Courses with interdisciplinary character’ and ‘Courses with transdisciplinary character’. As can be seen from Table 4, while the majority of the SISSTEM courses (67%) are still fundamental STEM courses, mostly needed as baseline knowledge, 33% are either interdisciplinary or transdisciplinary in nature.

Table 4: Overview of the SISSTEM courses taught at the UA⁶, according to their nature. The number of credits according to the ECTS system can be found between parentheses. Courses from the specialization tracks: * Bio-environmental Sciences, ** Information and Data Sciences, * Technology and Engineering**

Traditional STEM courses	Courses with interdisciplinary character	Courses with transdisciplinary character
Applied mathematics (6)	Principles of sustainability and SDGs (6)	Integrative project (6)
General chemistry (6)	Environmental sciences (6)	Entrepreneurship, Innovation & Society (6)
Basics of physics (6)	Socio-ecological systems (6)* Software Project Management (6)**	
Geosciences (6)	Renewable energy (6)***	
Applied biological sciences (6)	Interdisciplinary and multidisciplinary approaches to sustainable development (6)	
Statistics and advanced mathematics (6)	Environmental law and policy (6)	
Introduction to informatics (6)		
Physics: electromagnetics (6)		
Bioorganic chemistry and biochemistry (6)		
Materials Engineering (6)		
Bioeconomics (6)		
System and control theory (6)		
Ecophysiology (6)*		
Environmental chemistry (6)*		
Signal processing (6)**		
Machine learning (6)**		
Chemical and environmental separation processes (6)***		
Automation and process control (6)***		
Total credits: 108 ECTS – 67%	Total credits: 42 ECTS - 26%	Total credits: 12 ECTS – 7%

⁶ Students are expected to spend their 5th semester in a host institute abroad and to attend courses within their specialization and do lab and/or field work. Furthermore, in the third bachelor year, students have to conduct research and write a bachelor thesis. As the content of the exchange program and the topics of the bachelor thesis vary with the student, we do not take this into account in the calculations.

I still feel that there is a lack of coordination and a lack of, what is the best word for this, alignment between courses.

[SISSTEM staff member at the UA]

Some respondents indicated that the interdisciplinarity and coherence between the different bachelor courses is not yet entirely up to the intended level. While oversight and coherence of the programme is clear at management level, collaboration and true interaction between the content and the lecturers still needs further improvement. Respondents indicated that this is mainly because the programme is still in its first iteration, and therefore that this is a work in progress. On the research side of the programme, the PhD candidates have very different academic backgrounds and come from different countries. As such, different specializations, experiences and networks are automatically introduced into the programme. From the management side, there are serious attempts to bring the SISSTEM staff members together on a regular basis to discuss their research and the development of the education programme in order to benefit from these different backgrounds and networks and to encourage the cross-fertilization and integration between the different disciplines.

Finally, Stephens *et al.* (2008) highlight the traditional focus of universities and faculties to disseminate research results via publications in academic journals. In the SISSTEM program, there is both a focus on this traditional academic dissemination of knowledge via academic publications as well as the sharing and co-creation of knowledge via collaboration with local and international stakeholders. This is discussed in detail later in the chapter.

SISSTEM and the Democratization of Education

In terms of education, and what I noticed is it is not only a problem for Aruba, it is a problem all over the Caribbean, is a problem of brain drain.

[SISSTEM staff member]

In Aruba, the largest growth in the labour market occurs in sectors that require relatively highly-skilled labour. Similar to other Caribbean islands, the labour participation increases with the level of education. While in Aruba low-educated people have an unemployment rate of 12.6%, highly-educated people have an unemployment rate of only 3.3% (Hermans and Kösters, 2019). Until recently, the absence in Aruba of higher education in STEM made the island completely dependent on external education and expertise in those fields, also leading to a brain drain of local talents and a lack of a sustainable knowledge base on the island itself.

Indeed, respondents indicated that due to the lack of higher STEM education, students with interest in STEM go abroad, often to the Netherlands or to the USA, and after their studies tend not to return to the island. Furthermore, even if graduated students would come back, they will have missed the island context in their education. Besides the issue of brain drain, respondents indicated that studying abroad comes with its own challenges for these young students, as they often move to far-away countries with a different culture, sometimes being confronted with racism and discrimination. Additionally, studying abroad is costly, and while study loans are available for studying in the Netherlands, these loans still have to be paid back after their studies, leaving freshly graduated students with large debts. Finally, respondents also

remarked that not all Arubans have the opportunity to leave the island as they might have other responsibilities like their family or a job.

While if you have studied here, there is a higher chance that you will also continue to work here. So that is why we think that in order to expand the labour market in STEM subjects, it is also important that they study here.

[Stakeholder wider Aruban society]

The SISSTEM programme aims to contribute to stopping this brain drain and to creating new opportunities by locally educating these students and training them to address the sustainability challenges in their own country or region.

Some respondents indicated that extra efforts might be needed to provide a clear communication of the bachelor programme's content in order to attract the right subset of students who are able and willing to study fundamental STEM courses in a sustainability context. The SISSTEM program is accessible for all students coming out of the highest-level secondary schools with a sciences track in Aruba, which are organized according to the Dutch education system. Other students who come from the second highest-level of schooling or who are missing (part of) the science track can be admitted to the programme after they successfully have passed the Academic Foundation Year, which acts as a bridge year between high school and the university. Students older than 21 years and who do not have the prerequisite education, but who have gained the necessary study experience through alternative pathways, can take a colloquium doctum exam to access the program.

The tuition and administration fee for the SISSTEM program is 2500 AWG (USD 1400) for Aruban students or holders of a Dutch passport and 8500 AWG (USD 4725) for non-Dutch passport holders with less than five years of official residence in Aruba. These tuition fees are low compared to other institutions in the Caribbean region, but they can be perceived as high as they are about the same as the average monthly wage in Aruba. However, in most cases, students also have access to a study loan, which they have to pay back after their studies. Given the relatively high cost of living in combination with the tuition fees, and the fact that the programme also accommodates some older students with families, some of these students have full-time jobs besides their studies. Although such combination is possible, it is very challenging.

Like almost all other programmes organized at the UA, the SISSTEM program aims to obtain a positive evaluation by the NVAO (Nederlands-Vlaamse Accreditatie Organsiatie). This organization is responsible for the accreditation of higher education programmes and/or institutions both in the Netherlands and in Flanders based on a professional and independent evaluation process. Through this accreditation process, the neutrality and transparency of the programme is guaranteed. At the time of writing, the SISSTEM program has not yet obtained this accreditation as the procedures can only be started once the program has gone through the first full bachelor cycle.

SISSTEM and its Communication and Interaction with Society

As stated by Stephens *et al.* (2008), the issue of communication should be evaluated at two levels: (1) internally, within the higher education system; and (2) externally, with non-academic stakeholders (Stephens *et al.*, 2008).

The internal communication within the higher education system is covered in different ways in the SISSTEM programme. At KU Leuven, a postdoctoral researcher is assigned to facilitate and ensure all communication between the KU Leuven professors and the UA staff members. A general SISSTEM meeting is organized every six months and is attended by the different KU Leuven professors and the members of the SISSTEM steering committee. Furthermore, *ad-hoc* meetings are organized when necessary between the KU Leuven professors and the UA senior lecturers. At the UA, regular meetings are organized, attended by all UA SISSTEM staff members. During these meetings, current issues of the programme are discussed. The PhD candidates are asked to present their research results as part of building up the academic research capacity at UA. As UA SISSTEM staff members have very different backgrounds, these regular internal meetings, whereby knowledge from different backgrounds and experiences is shared, are crucial to obtain a more holistic approach of the sustainability challenges addressed within the programme.

The external communication with non-academic stakeholders is covered by the triple-helix platform. The goal of this platform is to establish a network with local and international parties that functions as a hub where businesses, institutes, governments, and NGOs can share experiences, knowledge and resources. At the academic level, PhD candidates focus on publishing their research results via academic journals and the program organizes international research seminars under the title "Sustainable Island Futures", at which graduate students and other researchers from SISSTEM as well as partner institutions present and discuss their research

on sustainability issues in SIS. Also, network sessions are organized to link the PhD researchers with stakeholders. Every six months, the programme sends out a newsletter that highlights the achievements and outputs of the program.

With regards to the bachelor programme, as already outlined in Table 3, in the SISSTEM “Integrative Project” course the students reach out to stakeholders within the Aruban society in order to collaborate on a specific sustainability challenge. At the end of the course, the results of the assignments are not only discussed and evaluated internally, but also presented to the stakeholder with whom they collaborated. Current stakeholders involved include for instance the Aruba Airport Authority and the Marines barracks. Additionally, for the course “Entrepreneurship, Innovation and Society” different members of the Aruban or wider Caribbean society are invited to give a talk on various topics related to entrepreneurship, innovation and society in a SIS context. Also in other courses, connections are made with the Aruban society. A nice example is the seagrass monitoring project being set up together with the Aruba National Park Foundation, with whom the UA has a Memorandum of Understanding for collaboration, in the context of the “Environmental Sciences” course. Furthermore, networks and collaborations are being set up with other universities both in Europe as well as in the USA and in the Caribbean. Based on these networks, students can then go abroad during their fifth semester for laboratory work experience and to follow specialized courses not currently offered at the UA. In the long run, the SISSTEM programme hopes to host foreign students from other universities in the context of an exchange programme like Erasmus+. Finally, the SISSTEM program is putting lots of effort in promoting the SISSTEM bachelor program both inside and outside Aruba.

For the research component of the programme, the SISSTEM staff members frequently reach out to the wider Aruban and Caribbean society and community. They connect in order to acquire

data via various methods, including stakeholder group meetings, focus groups, multi-criteria analysis, citizen science, interviews and surveys, etc. However, respondents indicated that at least until now, it has been a challenge in some cases to acquire sufficient data and to get certain stakeholders on board to share their data and knowledge. Reasons for this reticence when it comes to sharing information are, according to respondents, unfamiliarity with STEM research at the UA; a sense of distrust towards how and for what purpose the data is going to be used; or not seeing the personal benefit of putting effort into sharing the data. Respondents, however, noted that with time, as the SISSTEM programme becomes better known, as publications emerge, and networks have further developed, this challenge can be overcome. Respondents from the wider Aruban society mentioned the need for extra efforts to make the Arubans more aware of the existence of the SISSTEM programme. Efforts like the publication of newspaper articles and videos, and a broad social media campaign have now been put into place that should answer this need. Additionally, respondents also indicated that their goal is to actively share their research results with the Aruban society, for example via newspaper articles. Some SISSTEM staff members at the UA indicated that they were hesitant to do so, as they fear that this might result in unmanageable expectations from the small local community, which in the end might not be met. Towards the academic field, these fears are less prominent and, as said before, research results are shared via publications and participations in symposia and conferences.

Final Discussion – Can SISSTEM be an Effective Agent of Change for Aruba and Other SIS?

Table 5 presents an overview of the different elements that are instrumental for SISSTEM to address the five critical factors identified by Stephens *et al.* (2008) and links them to the barriers, lessons learnt and recommendations as identified through the analysis of the semi-structured interviews. From Table 5 it is clear that the SISSTEM programme is actively focusing its activities on all five critical factors. As such, we can conclude that the programme has a significant potential of indeed becoming a critical change agent in Aruba, the Caribbean, and potentially other SIS.

However, as is also clear from Table 5, setting up this programme in Aruba does come with its own challenges. Many barriers identified relate to what we can capture under the term of “growing pains”. Indeed, the programme is still young, and some barriers arise as its development is progressing. For example, underestimating the difficulties in finding suitable academic staff who have sufficient affinity with the sustainability challenges in SIS, the time required to further incorporate the local sustainability challenges into the curricula, and the time required to build up trust amongst both the potential future students as well as the broader Aruban society to become involved in the SISSTEM program, either by attending the programme or by sharing data, etc. Other concerns relate to the long-term financial sustainability of the program itself.

The aforementioned results are based on an explorative case-study analysis. A limitation of our research is that the interviews were conducted during the early development phase of the programme, clearly showing the potential. It is, however, difficult to claim on the basis of these data whether the programme can actually have an effective impact on Aruba. This will only be possible within a few years. However, examples like the seaweed monitoring project as well as the sustainability assessments at the Marines’ barracks and at the Aruba Airport Authority make

us believe that the chances are very high that SISSTEM will become an effective agent of change in Aruba and potentially also the wider Caribbean. The study presented in this chapter focuses on the potential that is built into the structure, goals and curriculum of the SISSTEM programme. Within a few years' time, when the SISSTEM programme has had sufficient time to be fully deployed, further studies should be carried out on its ability to deliver on its potential based on measurable outcomes, including employability of the graduates in positions that truly impact the sustainable development of Aruba and comparable SIS. Other potential future research could be a similar analysis of case studies in other similar regions in order to propose more general recommendations.

Table 5: Overview of implementation of critical factors in SISSTEM, barriers, lessons learned and recommendations

Critical factor	Elements instrumental in change	Barriers, lessons learned and recommendations
Dominant sustainability challenges	Island context and sustainability as backbone of the SISSTEM programme with staff members embedded in the local island context, courses adapted to the local context and research topics especially designed to address sustainability challenges in Aruba and other SIS.	Need for sufficient staff members acquainted with the local context, which has proven to be more challenging than initially expected. Therefore, extra emphasis and efforts needed to be put into attracting suitable staff members. At a certain point, the local embeddedness might have to be dropped, but then extra effort is needed to keep the insular focus. KU Leuven staff members not always able to fully grasp the local complexities. Efforts needed to keep communicating specific challenges of Aruba and other SIS. Need for patience and flexibility of KU Leuven staff members. Time needed for the programme to grow and courses to be further adopted to the local context.
Financing structure and independence	Financial kick-start by the EU, allowing the programme to be developed, but also generating trust and attractivity to the programme for some, and making intensive partnership with KU Leuven possible. Independence of education and research guaranteed through accreditation by NVAO.	Long-term financing and therefore long-term sustainability of the programme is guaranteed by Government funding agreed upon before the start of the initial project. However, when the initial EU funding stops, partnership with KU Leuven will be more on a voluntary individual level. Attracting sufficient students to the programme from within and outside Aruba essential to ensure the long-term financial sustainability of the program.
Institutional organization	Focus on interdisciplinarity and transdisciplinarity throughout the educational bachelor programme and in the research, allowing for a holistic view Natural interdisciplinarity as SISSTEM staff members and KU Leuven staff members all have different backgrounds and are sharing their expertise	Interdisciplinarity and coherence between different courses not yet entirely up to level as there is time needed for this coherence to develop further. Regular meetings and interactions needed to profit from and further exploit the interdisciplinary character of SISSTEM staff members.

Democratization of education	<p>SISSTEM as a solution for brain drain and as means to locally educate highly skilled work force to contribute to the Aruban society.</p> <p>Allowing Arubans and citizens of the wider Caribbean to study in STEM in their own region without having to move to far-away countries, which is sometimes impossible due to personal factors. They can study in their own setting and be educated with knowledge which can directly be applied in the region.</p>	<p>Different entry levels of students, which is reduced through the Academic Foundation Year and the colloquium doctum exam.</p> <p>However, extra efforts might be needed to provide a clear communication of the bachelor programme's content in order to attract the right subset of students who are able and willing to study fundamental STEM courses in a sustainability context.</p> <p>Positive evaluation of the bachelor programme by NVAO is essential to guarantee the value of the bachelors' diploma at local and international level</p>
Communication and interaction with society	<p>Large efforts being made to set up networks and collaborations with local and regional stakeholders, both for the educational as well as for the research programme. Networks are being formed, collaborations on research have been set up (e.g. seaweed project, collaboration with Marines' barracks sustainability projects and with Aruba Airport Authority SDG strategic plan). Regular communications to the Aruban and Caribbean society on research results.</p> <p>Internal communication is well established with regular internal meetings.</p>	<p>Stakeholders not always prepared to share data due to unfamiliarity with STEM research at the UA, sense of distrust, and lack of seeing personal benefits.</p> <p>Extra efforts needed to make the wider Aruban society aware of the SISSTEM project and its intended goals and to generate trust.</p>

Conclusion

In this chapter we evaluated whether the SISSTEM programme, currently being set up in a collaboration between the University of Aruba and KU Leuven, Belgium, has the potential to be an effective change agent for sustainability in SIS in general and in Aruba in particular. The evaluation has been done based on the five critical factors identified by Stephens *et al.* (2008). While the SISSTEM programme has started only recently, the positive evaluation of the programme for each of these factors allows us to conclude at this stage that the SISSTEM programme indeed has a significant potential to be an agent of change for sustainability in Aruba and potentially other SIS. The approach of the SISSTEM programme, its barriers and the lessons learned have been described in this chapter. This can be of interest for other universities around the globe that aim to develop new or to enhance existing curricula in order to become change agents for sustainability.

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Annex 1 - Interview guide to steer semi-structured interviews

Specific to the use of semi-structured interviews is the development of an interview guide. As such, we prevented to forget important topics and at the same time we kept the freedom of going deeper into a particular topic and ask additional questions when this was considered interesting to better understand what was actually meant by the respondent. In practice, we kept the main structure of the interview guide for each respondent, but we made adjustments based on the “type” of respondent, as we believed they could provide a different kind of information. For example, although the topics remained the same, slightly different questions were asked to steering committee members, KU Leuven professors, SISSTEM PhD students and SISSTEM senior lecturers. Not all respondents were able to answer all questions, as they would have lacked sufficient background on the SISSTEM program (e.g. respondents from the wider Aruban society) or of the educational system in Aruba (e.g. SISSTEM staff recently arrived in Aruba or KU Leuven professors).

Introduction questions

- Can you shortly introduce yourself?
 - What is your function in daily life?
- When did you first hear about the SISSTEM programme and how did you get involved?
 - If involved early in the project: Could you present briefly the history of the SISSTEM program and project? What were the main drivers to develop the project and program?
- If SISSTEM staff member
 - Why did you apply for this job? What attracted you to this job?

- If you would need to explain the SISSTEM programme to someone who is not familiar with the project or the programme, how would you do this?
- Aruba and other small island states have some distinct challenges. According to you, what are the main challenges of Aruba and other small island states?

General questions on education system⁷

- Can you give a bit of background on the university system in Aruba
 - Is the University of Aruba accessible for every Aruban or are there limitations?
 - What are the subscription fees and how to these compare to the average Aruban income?
 - Are there scholarships and how do they function?
- According to you what is the main function of a University?
 - What role has the University of Aruba in the Aruban society?
 - What role could the UA potentially have?
 - According to you what is the perspective of the Aruban society on the University?

Research

- If SISSTEM PhD researcher / senior lecturer / KU Leuven professor involved in SISSTEM research:
 - Can you explain the research topic?
 - What do you hope to achieve with the research?

⁷ Not all respondents were able to answer all of these questions, as some of them arrived only recently in Aruba and did not know the details of the local education system.

- How do you hope to impact the Aruban society and that of other small island states?
- What challenges do you encounter in the research?
- Are you free to research anything you want, or are there limitations?
- Do you plan to communicate your results to the Aruban society?
- Do you discuss your research results at a regular basis and with who?
- Do these discussions have an influence on your research and how?

Teaching

- For SISSTEM junior lectures and senior lecturers
 - Which courses do you teach. Can you explain what they are about?
 - In your courses, do you try to make a connection with the sustainability challenges of Aruba and other SIS and how?
 - What do you hope to achieve with your courses? What should the students remember from your course?
 - What are the challenges you encounter in teaching?

General closure questions

- What are the main successes of the SISSTEM programme so far?
- What are the main challenges of the SISSTEM programme so far?
- When would you consider this project to be successful?
- How do you see the future of the SISSTEM programme?