Smart City Regulation and Environmental Sustainability in the Context of Land Use Planning in Mauritius: A Critical Review

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Online ISSN
1727-3781

P·E·R

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Date Submitted

10 March 2023

Date Revised

4 August 2023

Date Accepted

12 September 2023

Date Published

23 November 2023

Guest Editors

Prof AA du Plessis
Prof LJ Kotzé

Journal Editor

Prof C Rautenbach

How to cite this article

Lim Tung OJ "Smart City Regulation and Environmental Sustainability in the Context of Land Use Planning in Mauritius: A Critical Review" *PER / PELJ* 2023(26) - DOI http://dx.doi.org/10.17159/1727-3781/2023/v26i0a17151

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DOI
http://dx.doi.org/10.17159/1727-3781/2023/v26i0a17151

Abstract

A "smart city" involves planned urbanisation, a system which has been adopted in many countries involving tailor-made solutions to suit local challenges while making the most of local opportunities. Smart city initiatives started in Mauritius in 2015 after the "Smart City Scheme" (SCS) Regulations were issued the same year under the *Investment Promotion Act* (IPA). By 2021 there were twelve approved smart cities in the main island of Mauritius in different phases of completion, while other such projects are seeking approval.

While the smart city concept encourages the development of land into coordinated urban planning, it is mostly agricultural land in Mauritius which is being targeted for such real estate investment. The conversion of some lands belonging to large sugar companies for development into hotels and leisure facilities was part of the Mauritian government strategy to diversify the sugar industry after the dismantling of the African Caribbean Pacific-European Union (ACP-EU) *Sugar Protocol*. Since 2002 the IPA has enabled the development of luxury residential property in the Integrated Resort Scheme (IRS). As from 2007 the Real Estate Development Scheme (REDS) included not only the IRS but also the Real Estate Scheme (RES) and the Invest Hotel Scheme (IHS), which are smaller in size and more affordable. In 2015 Mauritian decision-makers came up with the "smart city" concept as a blue-print for coordinated urban planning with large-scale mixed-use developments involving smart technology and pioneering innovation. Regulatory approval for a "smart city" project includes a SCS certificate, a Land Conversion Permit where necessary, an environment impact assessment (EIA), a licence and a Building and Land Use Permit, all of which are issued via a fast-track procedure.

As a small island developing State (SIDS) Mauritius has limited land resources and it is important that the setting up of smart cities should be limited and environmentally sustainable. Setting up a smart city involves more than mere urbanisation and property development, and the plan must be carefully evaluated. This paper critically reviews the regulation of smart cities and smart city initiatives in the context of land use planning in Mauritius to consider the extent to which they are environmentally sustainable, and makes recommendations to improve their environmental sustainability.

Keywords

Smart city; environmental sustainability; regulation; standards; energy efficiency; efficient water use; waste management; optimisation of environmental resources.

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1 Introduction

The concept of a "smart city" can be traced back to the early 1990s, when cities embraced information and communication technology (ICT) systems, electronic governance and incentives for high-tech industries.[1] Since then urbanisation has increased in many developed and developing countries where smart cities have been set up with tailor-made solutions.[2] There are several definitions[3] of the concept of a "smart city" in different countries, but a generally applicable definition or common understanding of this concept is yet to be adopted. After analysing a hundred definitions of smart cities, the United Nations (UN) specialised agency for information and communication technologies' definition of a smart city[4] is as follows: "A smart sustainable city is an innovative city that uses information and communication technologies and other means to improve quality of life, efficiency of urban operation and services, and competitiveness while ensuring that it meets the needs of present and future generations with respect to economic, social and environmental aspects."[5] However, this definition does not provide details on the environmental aspects of a sustainable smart city.

While smart cities have been mainly set up in developed and developing countries, sustainable urban development is also important for small island developing states (SIDS) since they have limited land.[6][7] Smart city

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1 DCG *South African Smart Cities Framework* 6.

2 Top world smart cities include Singapore, Zurich, Oslo, Taipei City, Lausanne, Helsinki, Copenhagen and Geneva. See the annual globally recognised Smart City Index Report according to Smart City Observatory. SmartCitiesWorld Date Unknown https://www.smartcitiesworld.net/smart-cities?topics=Singapore. The South African smart city initiative needs to be inclusive and based on six guiding principles. DCG *South African Smart Cities Framework* 18.

3 The South African definition of a "smart city" is "a settlement where investments in human and social capital as well as traditional and modern communication infrastructure fuel sustainable economic development, a better quality of life and prudent management of natural resources". DCG *South African Smart Cities Framework* 3.

4 ITU 2016 https://www.itu.int/en/ITU-T/focusgroups/ssc/Pages/default.aspx.

5 ITU 2016 https://www.itu.int/en/ITU-T/focusgroups/ssc/Pages/default.aspx.

6 UN Date Unknown https://www.un.org/ohrlls/content/about-small-island-developing-states#:~:text=The%20aggregate%20population%20of%20all, %2C%20economic%2C%20and%20environmental%20challenges. Singapore as the leading smart city nation recognised as a world leader in its smart mobility policies and technology can be inspiring for SIDS. SmartCitiesWorld Date Unknown https://www.smartcitiesworld.net/smart-cities?topics=Singapore.

7 Singapore is one of the top world smart cities. See SmartCitiesWorld Date Unknown https://www.smartcitiesworld.net/smart-cities?topics=Singapore.

initiatives started in the main island of the Republic of Mauritius[8] (hereafter "mainland Mauritius") in 2015 with the Smart City Scheme (SCS) Regulations (hereafter the "SCS Regulations") under the *Investment Promotion Act* (IPA).[9] The smart city concept for Mauritius has to do with "work, live and play" and involves large-scale mixed-use developments in an urban context with opportunities for innovation-driven businesses and multiple leisure amenities.[10] Smart cities in Mauritius can be said to be new urban developments as opposed to existing cities adjusted to a smart city model. Smart city projects can be set up in the country with specific conditions, fiscal incentives and permanent residency facilities as per the Board of Investment (BOI) SCS Guidelines 2015, which were amended in 2020.[11] By 2021 there were twelve smart cities[12] in mainland Mauritius in different phases of completion, although Mauritius is a SIDS with twelve main cities (with more than 15 000 inhabitants each) excluding smart cities.[13]

While smart cities can be assessed according to different dimensions of sustainability, namely environmental, economic or social dimensions,[14] this article deals only with the environmental aspects of sustainability. Environmental sustainability can be construed as meaning "the meeting of services and resources of present and future generations without affecting

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8 The term "mainland Mauritius" is used for the main island of the Republic of Mauritius (RoM) in this article to avoid confusion with the other dependencies of the republic. The republic includes mainland Mauritius and its dependencies. Mainland Mauritius has an area of 1,865 km^2. Until 1965 the most important dependencies of Mauritius were Rodrigues, the Chagos Archipelago, Agaléga and the Cargados Carajos (Saint Brandon). Tromelin has been claimed as a dependency of Mauritius by France. Lim Tung *Environmental Law in Mauritius* 30-35; Nations Online Date Unknown https://www.nationsonline.org/oneworld/mauritius.htm.

9 See GN 128 of 2015 (*SCS Regulations*) as amended in 2017; However, the *Investment Promotion Act* 42 of 2000 (the IPA) was repealed by the *Economic Development Board Act* 11 of 2017 (the EDBA).

10 The Board of Investment (BOI) SCS Guidelines 2015 (BOI 2015 https://www.academia.edu/19538132/Smart_city_scheme_guidelines (hereafter BOI *SCS Guidelines*)) were amended in October 2020 (EDB 2020 https://www.edbmauritius.org/sites/default/files/2020-11/Smart%20City%20Guidelines%20October%202020.pdf (hereafter EDB *SCS Guidelines*) 7).

11 GN 128 of 2015 (*SCS Regulations*) as amended in 2017; BOI *SCS Guidelines*; EDB *SCS Guidelines.*

12 EDB *SCS Guidelines*.

13 Population Hub Date Unknown https://population-hub.com/en/mu/list-of-cities-in-mauritius-by-population.html. The population of mainland Mauritius was estimated at 1,217,588 against a total of 1,262,523 for the Republic of Mauritius including its dependencies as at 1 July 2022. See Statistics Mauritius 2022 https://statsmauritius.govmu.org/Pages/Statistics/ESI/Population/Pop_Vital_Jan-Jun22.aspx#:~:text=As%20at%201%20July%202022,as%20at%201%20July%202021.

14 Toli and Murtagh 2020 *Frontiers in Built Environment* 2.

the health of the ecosystems that provide them".[15] Whereas there are different perspectives[16] on what providing an environmentally sustainable smart city could entail, for the purposes of this article the following perspectives based on International Standards for sustainable cities[17] and the UN perspective on Sustainable Cities will be referred to. "An environmentally sustainable city entails ways to manage cities or urban developments and the overall impact of human settlements on the environment, addressing in particular climate change and loss of biodiversity."[18] In accordance with the UN perspective on Sustainable Cities, sustainable cities need investment *inter alia* in "renewable energy sources, efficiency in the use of water and electricity, design and implementation of compact cities, retrofitting of buildings and increase of green areas, fast, reliable and affordable public transportation as well as improved waste and recycling systems".[19]

No scholarly article has been published on smart cities in Mauritius apart from a publication dating back to 2013, which targets sustainable cities in the country, making a critical assessment of the existing planning framework in order to promote effective sustainable cities.[20] As a SIDS Mauritius has limited land resources and the development of smart cities must be limited. In addition, they must be environmentally sustainable, taking food security into consideration, particularly in the light of the consequences of the Covid 19 pandemic and the consequences of the armed conflict between Ukraine and Russia. This article therefore addresses the gap in scholarly literature on smart cities and their environmental sustainability for Mauritius. It first presents an overview of

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15 Khan *et al* "Ecodesigning for Ecological Sustainability" 590. According to the United Nations (UN) Brundtland Commission in 1987, "sustainability" means "meeting the needs of the present without compromising the ability of future generations to meet their own needs". UN Date Unknown https://www.un.org/en/academic-impact/sustainability.

16 UN Date Unknown https://sdgs.un.org/topics/sustainable-cities-and-human-settlements*;* Toli and Murtagh 2020 *Frontiers in Built Environment*.

17 See the introduction of International Standard ISO 37101:2016. Mauritian Standards for sustainable cities are based on International Standards for sustainable cities (MSB 2019 http://mauritianstandards.com/wp-content/uploads/2020/08/MS-ISO_37104_2019E-Character_PDF_documentPREVIEW.pdf (MSB *MS ISO 37104:2019*); MSB 2019 http://mauritianstandards.com/wp-content/uploads/2020/08/MS-ISO_37106_2018E-Character_PDF_document-1PREVIEW.pdf (MSB *MS ISO 37106:2018*))*.*

18 MSB *MS ISO 37104:2019* vi.

19 UN "Towards Sustainable Cities" 53*;* Toli and Murtagh 2020 *Frontiers in Built Environment* 6. A vital pillar of a smart city project is to have a smart environment and its ability to increase sustainability and better manage natural resources through the use of smart policies and smart applications. See EDB *SCS Guidelines* 57.

20 Baguant-Moonshiram, Samy and Thomas 2013 *The Sustainable City* 247.

smart cities in the context of land use planning in Mauritius as well as the concept of environmental sustainability in Mauritius. Then it analyses the current domestic legal and policy framework regulating smart cities in Mauritius and its smart city initiatives in the context of land use planning to examine how far they can be considered as environmentally sustainable. It also makes recommendations for improving their environmental sustainability.

While predominantly oriented towards cities, the paper also broadly reflects on the issue of land use and planning law, and how these intersect with sustainability at the local level. This focus aligns with and speaks to the pioneering body of scholarship that Willemien du Plessis has thoughtfully developed over the course of many years. Her scholarship, especially insofar as it relates to the African context, has managed to substantially shape the discourse in these fields. This is a tribute to her scientific accomplishments and the mentoring role she has played to empower the next generation of African environmental law scholars.

2 Background on land use planning and smart cities in Mauritius

This section provides an overview on smart cities in Mauritius taking into consideration land use planning and the sugar reform in order to have a better picture of the context in which smart cities have been set up. When Mauritius was under the French and British colonial powers there was no land use planning as such, and these powers set up towns and villages in mainland Mauritius to suit their priorities and activities. That was the position until Mauritius became independent in 1968.[21] The first formal legislation regarding urban planning in Mauritius was the *Town and Country Planning Act* (TCPA) in 1954.[22] The 1994-2010 National Physical Development Plan (NPDP)[23] was the first guiding framework for land use to monitor physical development and environmental management for

21 Her Majesty the Queen of Great Britain was the Head of State until 1992, when Mauritius adopted a republican status. Lim Tung *Environmental Law in Mauritius* 29-30; See the Mauritius Independence Order in GN 54 of 1968.

22 Baguant-Moonshiram, Samy and Thomas 2013 *The Sustainable City* 247; Lim Tung *Environmental Law in Mauritius* 29-30.

23 Section 5 of the *Town and Country Planning Act* 6 of 1954 (the TCPA) empowers the Minister to institute a survey of Mauritius and review the development and planning of each of the areas of Mauritius. The 1994 National Physical Development Plan (NPDP) contains public sector investment programmes and provides for the contents of general schemes and development with environmental control criteria. The 1994 National Physical Development Plan (the NPDP) is the guiding framework for land use from 1994-2010 to monitor physical development and environmental management for mainland Mauritius. It contains public sector investment programmes and provides for the contents of general schemes and development with environmental control criteria. See Lim Tung *Environmental Law in Mauritius* 286.

Mauritius. Urban planning can be considered a relatively recent form of land use management in Mauritius, its effectiveness depending on the priorities of the governmental team in power from time to time.

When Mauritius became independent sugar cane farming was the main economic activity. Over the past few decades mainland Mauritius used 45% of its available land for agricultural purposes.[24] Sugar cane cultivation constituted 39% (72 000 hectares (ha)) of the total available land in 2005,[25] while by 2012 the cultivation of sugar cane had decreased to 57 300 ha, since the sugar sector was subject to a reform[26] due to the dismantling of the African Caribbean Pacific-European Union (ACP-EU) *Sugar Protocol*. Mauritius therefore diversified its agricultural sector and revisited planning for the sugar sector in order to cultivate different crops and livestock instead of producing sugar without the safeguard of a guaranteed price under the above *Sugar Protocol*.[27] Greater efficiency was targeted for the local sugar cane production sector, as well as the conversion of agricultural land to non-agricultural use.[28]

The conversion of some agricultural lands belonging to large sugar companies to the purposes of the development of hotels and leisure facilities was part of the Mauritian government's strategy to diversify the sugar industry after the EU sugar reform, and to boost the tourism industry.[29] Since 2002 the IPA has enabled the foreign ownership of residential property under the IPA regulations catering for the development of Integrated Resort Schemes (IRSs).[30] In 2007 the Investment Promotion (Real Estate Development Scheme) Regulations[31] set the legal framework for the development of the Real Estate Development Scheme (REDS), which includes IRS, RES and Invest Hotel Schemes (IHS). A RES is a smaller scale development than an IRS, but the RES must be on freehold

24 Lim Tung *Environmental Law in Mauritius* 30.

25 It has an area of 1,865 km^2. From 1995 to 2005 the land occupied by sugar cane decreased by 6.3%, tea plantations by 81.6% and forest by 17.2%, mainly at the expense of built-up areas. CSO *Digest of Environmental Statistics* 13.

26 MESD *Mauritius Environment Outlook Report* 64; Lim Tung *Environmental Law in Mauritius* 285. Some African, Caribbean and Pacific (ACP) States (including Mauritius) and India had had arrangements under the *Sugar Protocol to the ACP-EC Cotonou Partnership Agreemen*t (1975) to supply sugar on preferential terms to the EU market. CEU 2007 https://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/misc/96172.pdf.

27 MESD *Mauritius Environment Outlook Report* 64; Lim Tung *Environmental Law in Mauritius* 285.

28 Lim Tung *Environmental Law in Mauritius* 294; Statistics Mauritius 2021 https://statsmauritius.govmu.org/Pages/Statistics/ESI/Environment/Env_Yr21.aspx.

29 Lim Tung *Environmental Law in Mauritius* 286.

30 GN 116 of 2002 repealed by GN 217 of 2007; GN 217 of 2007.

31 GN 217 of 2007 (the *Investment Promotion (REDS) Regulations*); GN 129 of 2015.

land.[32] The IHS consists of the development of hotels over 1 ha of land, whether on freehold or leasehold.[33] Residential properties under the IRS were mainly developed by large sugar companies but RES and IHS are smaller in size and offer more affordable residential property for potential investors. In furtherance of this real estate investment policy, Mauritius came up with the "smart city" concept in 2015 as a type of coordinated urban planning with large-scale mixed-use developments, smart technology and pioneering innovation. The Mauritian National Budget 2015-2016 encouraged investment in property development with the setting up of eight smart cities in Mauritius and five projects targeting "technopoles" covering 7 000 arpents of land.[34]

By 2021 there were twelve smart cities[35] in mainland Mauritius[36] which were either completed or being completed, while other such projects were seeking approval. In the east of mainland Mauritius, *Mon Trésor*[37] Smart City by the Omnicane Group for *Mon Trésor* and *Mon Désert* Limited was one of the first smart cities, while the West included Uniciti[38] by *Médine* Sugar Estate and *Cap Tamarin*.[39] In the North, smart cities included *Beau*

32 Freehold land does not include beachfront property, which is normally on lease by the state.

33 An IHS project relates to a hotel to be constructed within a clearly defined hotel development area. Regs 18A and 18B of the *Investment Promotion (REDS) Regulations*.

34 See Lim Tung *Environmental Law in Mauritius* 285.

35 EDB *SCS Guidelines*.

36 Mauritius has limited land resources (an area of 1,865 km^2).

37 The Mon Trésor Smart City project is close to the airport and comprises a business gateway, offices, logistics/light industrial park, freeport zone, 600 residential lots, 300 villas/duplexes, 100 apartments, a commercial centre, a leisure complex, a small and medium enterprises (SMEs) incubator, a film studio, a civic centre, an education and art hub on freehold land of an extent of 184.1018 ha at Mon Trésor and La Cambuse. See MTSCCL Date Unknown https://environment.govmu.org/Documents/eia/eiareports/2018/2211-smart%20city%20tresor/mtsc1.pdf. Trade Park Mon Trésor Ltd has also declared an area of 24.1620 ha out of the smart city project as a freeport zone. Lexpressproperty 2017 https://www.lexpressproperty.com/en/news-advices/invest/our-files/the-smart-city-scheme/projects-under-the-smart-city-scheme.html.

38 This smart city project has a total surface area of 350 ha and has a mix of residential, industrial, commercial, medical and recreational developments. See Medine Date Unknown https://www.medineproperty.com/master-planning-communities/.

39 It is a mixed-use development by Trimetys Limited with an education zone, office spaces, a boutique hotel, residential units, a civic centre and public amenities including jogging and cycle tracks. Phase 1 of the project covers 105 arpents. Lexpressproperty 2017 https://www.lexpressproperty.com/en/news-advices/invest/our-files/the-smart-city-scheme/projects-under-the-smart-city-scheme.html.

Plan[40] Smart City and Jin Fei[41] Smart City, which obtained regulatory approval, while *Roches Noires* Smart City (RNSC) was still applying for approval. In the South the Savannah Connected Countryside[42] was still being completed. While most of the smart cities are in coastal areas, there are ongoing smart city projects (Montebello Smart City[43] and Moka[44] Smart City) in the centre of mainland Mauritius.

The following section presents the concept of environmental sustainability in Mauritian laws and policies before analysing the environmental sustainability of smart cities in the country.

3 The concept of environmental sustainability in Mauritius

The concept of "sustainability" can be said to be in its infancy in Mauritian policies, particularly in land and environmental planning.[45] The term "sustainable" can be said to have first been used mainly in national policies in the context of sustainable development. In 2008 the new longer term vision of the Mauritian Government was to turn the country into a

40 Terragri Ltd's smart city project extends over 540 arpents at Beau Plan with residential units, mixed use development, a creative park and a university campus development over 4.9 ha. Existing infrastructure such as *L'Aventure du Sucre* and *Beau Plan* Business Park has been included in the smart city. Lexpressproperty 2017 https://www.lexpressproperty.com/en/news-advices/invest/our-files/the-smart-city-scheme/projects-under-the-smart-city-scheme.html.

41 Phase 1 of the project extends over 49.4 arpents and started with the development of the hospitality component in 2016. Garden of Eden Square is based on Chinese architecture and will comprise a wedding and entertainment venue. Lexpressproperty 2017 https://www.lexpressproperty.com/en/news-advices/invest/our-files/the-smart-city-scheme/projects-under-the-smart-city-scheme.html.

42 The Savannah Connected Countryside covers 440 acres, including 365 acres in the scope of the Smart City Scheme in the South. Most of the 7 000 acres of this property will be cane fields and the coastline will remain as it is with cattle roaming randomly. Savannah Connected Countryside Date Unknown https://savannah.mu/en/smart-initiatives/.

43 Montebello Smart City (MaxCity) is in phase 1 on 50 ha with the Montebello Nature Walk on 1.5 km with centenary and endemic trees. The residential properties are built along the St Louis River Pedestrian walk. Montebello Date Unknown https://montebello.mu/.

44 Phase 1 of Moka Smart City will be a mixed-use development comprising 2 287 residential units, commercial and offices spaces, education and student accommodation, sports facilities, health and medical services, a business incubator and a bus terminus over freehold land of an extent of 456 arpents at Moka. Lexpressproperty 2017 https://www.lexpressproperty.com/en/news-advices/invest/our-files/the-smart-city-scheme/projects-under-the-smart-city-scheme.html. Arpent is an old French unit of land area that is used in Mauritius. 1 arpent is 0.85 acre (0.34 ha). Merriam Webster Dictionary 2023 https://www.merriam-webster.com/dictionary/arpent#:~:text=plural%20arpents%20%C3%A4r%2D%CB%88p%C3%A4%E2%81%BF(z,side%20of%20a%20square%20arpent.

45 Baguant-Moonshiram, Samy and Thomas 2013 *The Sustainable City* 247.

sustainable island with the "Maurice Ile Durable" (MID) concept to make Mauritius a model SIDS for sustainable development.[46] A policy, strategy and action plan to achieve sustainable development for the country was developed after consultation with local stakeholders.[47] The main objective of MID is to ensure energy efficiency, sound environmental management, a greener economy, a holistic education system and equity for all citizens to contribute to the country's growth.[48] As from 2015 Mauritius as well as other UN members have sought to implement locally the *Transforming our World: The 2030 Agenda for Sustainable Development* (thereafter the "2030 Agenda for Sustainable Development") with its 17 Sustainable Development Goals (SDGs)[49] with specific targets to be achieved by 2030. The "Mauritius Vision 2030" includes "sustainable development" as one of its main pillars[50] but it does not describe environmental sustainability. It refers to "development with a commitment to meet the needs of current generations of Mauritians without compromising the right of future generations to meet their SDG".[51]

The Masterplan on the Environment for Mauritius (2020-2030) is the first national environmental policy focussing on sustainability and its transition (*transition écologique*) in Mauritius.[52] It sets environmental sustainability as a strategic national priority without defining the term[53] but it covers eight thematic policies and strategies for Mauritius and Rodrigues to address extensive Mauritian environmental issues.[54] This 10-year policy and

46 MESD *Mauritius Environment Outlook Report* 15; MESD *Maurice Ile Durable Policy Strategy and Action Plan.*

47 MESD *Maurice Ile Durable Policy, Strategy and Action Plan*.

48 The goal of *Maurice Ile Durable* (MID) is to achieve sustainable development in the five E's (energy, environment, economy, education, equity). MESD *Maurice Ile Durable Policy, Strategy and Action Plan* 3-4.

49 UNDP *Transforming our World*. See the MESD *Maurice Ile Durable Policy, Strategy and Action Plan;* the *Three-Year Strategic Plan 2018/19-2020/21,* the *Mauritius Vision 2030* and the *Government Programme 2020-2024* are short term and longer-term action plans to transform Mauritius into an environmentally sustainable and economically vibrant country. RoM 2018 https://mof.govmu.org/Documents/Documents/Budget%202018-2019/Three%20Year%20Strategic%20Plan%20201819-202021.pdf; Foreign Affairs 2017 https://d1bf23g64f8xve.cloudfront.net/sites/default/files/downloads/policy-database//MAURITIUS%29%20VIsion%202030.pdf; RoM 2020 https://govmu.org/EN/programme/Pages/default.aspx.

50 Foreign Affairs 2017 https://d1bf23g64f8xve.cloudfront.net/sites/default/files/downloads/policy-database//MAURITIUS%29%20VIsion%202030.pdf.

51 Foreign Affairs 2017 https://d1bf23g64f8xve.cloudfront.net/sites/default/files/downloads/policy-database//MAURITIUS%29%20VIsion%202030.pdf.

52 MESWMCC *Environment Masterplan* vii.

53 MESWMCC *Environment Masterplan* vii.

54 "Environmental culture, urbanism and environmental policy, climatic change, coastal zone and marine environment, biodiversity and natural resources, pollution control, waste management, control of plastic waste". MESWMCC *Environment Masterplan* xv.

strategy acknowledges that the transition towards environmentally sustainable, low emissions and climate-resilient development pathways is necessary to achieve the 2030 Agenda for Sustainable Development.[55] The National Disaster Risk Reduction Management (NDRRM) Policy, Strategic Framework and Action Plan 2020-2030[56] also targets environmental sustainability by helping the Republic of Mauritius to build resilience to extreme weather events and disasters. The 2015 SCS Guidelines include a vision for smart cities as an "ecologically sustainable development" with the "proper management, development and conservation of natural and manmade resources" for a better environment that will contribute to creating a "sustainable circle economy".[57] These guidelines highlight that one of the pillars of a smart city is its ability to increase sustainability and better manage natural resources through the use of smart policies and smart applications.[58] In the 2020 SCS Guidelines the design of a smart city requires a combination of smart efforts to improve its inhabitants' quality of life, promoting economic growth and protecting the environment from degradation.[59] The guidelines require the spatial development of a smart city project to take into consideration sustainability,[60] but they do not provide any more detail on sustainability.

Mauritian laws do not provide a legal definition of "environmental sustainability". The *Environment Protection Act* (EPA) of 2002 does not define the term "sustainable" although the introductory part of the EPA states that it provides for the protection and management of the environmental assets of Mauritius and fosters harmony between sustainable development and environmental protection. According to the Mauritian SCS Regulations, a smart city is required to be an ecologically sustainable[61] development, but these regulations do not provide a definition of what "ecologically sustainable" refers to exactly. The smart city must have a coherent Master Plan focussing on innovation, sustainability, efficiency and the quality of life.[62] The *Economic Development Board Act* (EDBA) of 2017 includes the "Sustainable City Scheme" and the "Sustainable City Certificate", which will be indicated in guidelines issued under this Act, but there is no definition of such terms. There are guidelines on smart cities but not on sustainable cities.[63] There are standards for guidance on establishing smart city operating models for

55 MESWMCC *Environment Masterplan* vii.
56 NDRRMC 2020 https://ndrrmc.govmu.org/Pages/NDRRMStrategicFramework.aspx.
57 BOI *SCS Guidelines* 6-7.
58 BOI *SCS Guidelines* 45.
59 EDB *SCS Guidelines* 56.
60 EDB *SCS Guidelines* 56.
61 Regulation 4(b)(iv) in GN 129 of 2015.
62 See reg 4(a) of the *SCS Regulations*.
63 EDB *SCS Guidelines*.

sustainable communities and guidance on practical local implementation based on international standards but only summaries of such standards are publicly available.[64]

In the light of the lack of precision of the term "environmentally sustainable" in national policies and laws in Mauritius, a legal definition of the terms "environmentally sustainable" or "ecologically sustainable" and national guidelines in the country are necessary for better implementation. For the purposes of this article, environmental sustainability in Mauritius will include resource efficiency, climate change adaptation and mitigation measures and resilience to disaster to meet the needs of current generations of Mauritians without compromising the right of future generations to meet their SDGs. As a SIDS with limited land and natural resources, it is important for Mauritius to engage in environmentally sustainable land use projects and development pathways.[65]

After having looked into the concept of environmental sustainability in Mauritius, the following section of this paper analyses the environmental sustainability of smart cities against the backdrop of land use planning in the country.

4 Environmental sustainability of smart cities in the context of land use planning in Mauritius

The following sub-section provides an overview of the legal framework for smart cities and national policies which may apply to smart cities in Mauritius before analysing the environmental sustainability of such cities and making the recommendations necessary to improving their environmental sustainability.

4.1 Smart city regulation and policy in Mauritius

A smart city is regulated mainly in terms of size, design, purposes and sale, with different legal requirements for the certificates and permits to be obtained before starting its development. There are obligations for the smart city company regarding the sale of land and residential properties, permanent residency for non-citizens, as well as fiscal and non-fiscal incentives.

64 MSB *MS ISO 37106:2018;* MSB *MS ISO 37104:2019.*

65 Khan *et al* "Ecodesigning for Ecological Sustainability" 590-592. According to the UN Brundtland Commission in 1987, "sustainability" means "meeting the needs of the present without compromising the ability of future generations to meet their own needs". UN Date Unknown https://www.un.org/en/academic-impact/sustainability.

4.1.1 Regulation of smart cities in Mauritius

Although a specific or stand-alone law (e.g. Smart City Act) or subsidiary regulations under the *Building Act* or the *Planning and Development Act* (PDA) could have regulated smart cities, the SCS Regulations were set up under the IPA (hereafter the "SCS Regulations").[66] However, the EDBA repeals the IPA and any regulations made under the repealed IPA are deemed to have been made under EDBA.[67] Enacting a stand-alone legislation for smart cities may have brought more specialisation for regulation concerning smart cities but introducing smart city regulation within legislation regarding investment and economic development reflects the intentions of Mauritian decision-makers.

4.1.1.1 The Mauritian smart city concept

The Mauritian SCS Regulations do not provide the definition of a smart city. They enunciate that the object of the SCS is to promote the creation of smart cities across Mauritius with specific requirements in terms of size, project design and the use of land within a coherent Master Plan focussing on innovation, sustainability, efficiency and quality of life.[68] The SCS Regulations differentiate a smart city which is to be developed on land of at least 21.105 ha from a "technopole" project, which is smaller in size and has different requirements.[69] Smart cities are not like other types of property development in Mauritius, which include an IRS covering luxury villas on an area of land exceeding 10 ha,[70] and a RES with more affordable residential properties over an area of at least 0.4220 ha but not exceeding 10 ha.[71] A smart city project is meant to be a mixed land use

66 *SCS Regulations*.

67 Section 43(11) of the EDBA.

68 See reg 4(a) of the *SCS Regulations*.

69 The "technopole" project (reg 5(3) of the *SCS Regulations*) is closer to a "digital city" and may be developed on an area of less than 21.105 ha with high-tech industrial research and development facilities and high energy efficiency measures. It has to provide for business facilities with a mandatory innovation cluster and provide day-to-day management services through a Smart City Management Company (reg 5(3)(b) of the *SCS Regulations*). The requirement of a 25% sale of residential properties to citizens of Mauritius or members of the Mauritian Diaspora under the Mauritian Diaspora Scheme does not apply to the technopole project (reg 5(4) of the *SCS Regulations*).

70 An integrate resort scheme (IRS) project contains luxury villas (which do not exceed 0.5276 hectare (1.25 arpents)). See reg 5 of the *Investment Promotion (REDS) Regulations*.

71 The RES for small landowners allows the development of any mix of residences for sale mainly to non-citizens on freehold land of an extent of at least one arpent but not exceeding 10 ha. Approximately thirty projects with RES residences have been approved by the BOI. See reg 12 of the *Investment Promotion (REDS) Regulations*.

development with business facilities (with a mandatory innovation cluster), affordable residential properties, civic centres and leisure amenities.[72]

The SCS Regulations specify that a smart city is required to provide an environment-friendly working, living and leisure space with its own energy and water resources, state-of-the-art connectivity, smart modern transportation and reduced traffic congestion.[73] Every smart city project must contain residential properties on the land area planned for that purpose and built-up areas must not exceed 50 per cent of the total land area.[74] The SCS Regulations allow the smart city promoter or the smart city company to have his or her own vision of the smart city.[75] Local standards[76] on sustainable cities have been established, which potential developers could use to define their smart cities, but only summaries of these standards are publicly available. The standards are based on international standards such as the International Standards Organisation (ISO) 37106:2018 on sustainable cities and communities, which provide guidance on establishing smart city operating models for sustainable communities, and ISO 37104:2019 with guidance for the practical local implementation of ISO 37101 on sustainable cities.[77] At the international level, ISO 37122:2019 for sustainable cities and communities guides processes on the use of technology and data in view of organisational change "to develop an open, collaborative, citizen-centric and digitally-enabled operating model" for a sustainable city.[78]

4.1.1.2 Main procedural requirements for a smart city project

A smart city needs to respect specific conditions regarding its size, its design, its purposes and its sale, and has to respect land planning laws.[79]

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72 Regulation 5(1) of the *SCS Regulations*.

73 Regulation 4(b)(i) in GN 129 of 2015.

74 Affordable housing units for middle-income earners. Reg 5(2)(e) of the *SCS Regulations*.

75 Zygiaris 2013 *Journal of the Knowledge Economy* 217-218.

76 MSB *MS ISO 37106:2018*; MSB *MS ISO 37104:2019*.

77 MSB *MS ISO 37106:2018*; MSB *MS ISO 37104:2019*.

78 See the ISO Standard ISO 37122:2019 for sustainable cities and communities, which provides indicators for smart cities and was finalised in 2020. Other international bodies have contributed to or formulated smart city standards, namely the European Committee for Standardization, the European Committee for Electrotechnical Standardization, the British Standards Institute, the European Telecommunications Standards Institute (ETSI), the United Nations specialised agency for information and communication technologies (ITU) and the International Electrotechnical Commission (IEC) 53. DCG *South African Smart Cities Framework* 17-18; ISO 2019 https://www.iso.org/standard/69050.html.

79 Land use planning and management is mainly regulated by the TCPA, the *Planning and Development Act* 32 of 2004 (PDA) as well as other laws impacting on the planning process such as the *Local Government Act* 36 of 2011, the *Sugar Industry Efficiency Act* 20 of 2001 (SIEA), the *Cadastral Survey Act* 22 of 2011 and the *National Heritage Fund Act* 40 of 2003.

The SCS Guidelines[80] provide guidance to the promoters of SCS projects and assist decision-making in view of the need for regulatory approval. The roadmap to investing in a smart city requires a SCS certificate, a Land Conversion Permit where necessary, an environment impact assessment (EIA) licence and a Building and Land Use Permit (BLUP) from the District or Municipal Council. The SCS is administered by the Economic Development Board (EDB) assisted by the SCS Technical Committee in view of the implementation of the Scheme.[81]

A smart city promoter may submit an application for a SCS certificate without submitting a development proposal and letter of comfort for the smart city project. However, going through the development proposal stage may allow the EDB, in consultation with the parties concerned, to review, modify and adjust the development proposal or smart city project in view of the application for a SCS certificate.

A smart city promoter may submit a development proposal for the proposed smart city project with the project brief, the site location plan, and a document providing the existing land use and constraints, and proof of ownership of the land to the Chief Executive Officer (CEO) of the EDB.[82] This development proposal will go through a technical appraisal, which is mainly for the promoter to see whether the project may eventually be considered before engaging in such a project.[83] A letter of comfort will be issued by the EDB to the person who submitted the proposal if the development proposal meets the requirements of the SCS Regulations.[84] The letter of comfort issued by the EDB is valid for one year and at this stage the promoter of the project can go ahead with the more detailed planning of the project.[85]

The smart city promoter has to be registered as a company to be able to apply for the SCS certificate to develop the smart city.[86] An application for a SCS certificate needs to contain where appropriate the letter of comfort issued for the development proposal, the particulars of the smart city project, the implementation plan and the subdivision plan.[87] There are

80 The first SCS Guidelines came into being in 2015 (BOI *SCS Guidelines*) but they were amended in 2020 (see EDB *SCS Guidelines*).

81 The SCS was first administered by the BOI under the IPA, but the EDB replaced the BOI when the EDBA replaced the IPA (EDB *SCS Guidelines* 8).

82 Proof of ownership of land by way of an extract of deed certified by notary. Reg 7(2) of the *SCS Regulations*; EDB *SCS Guidelines* 13.

83 EDB *SCS Guidelines* 13.

84 Regulation 8(3) of the *SCS Regulations*.

85 EDB *SCS Guidelines* 14-15.

86 Regulations 7(1) and 9(1) of the *SCS Regulations*.

87 The sub-division plan contains any road to give access to public roads, construction works, the extent of all lots and green spaces, any river, feeder or

social obligations for the smart city company, which are indicated in the SCS Guidelines.[88] A social impact assessment will be required to identify the impact of the smart city project on its neighbouring community with a written undertaking that the smart city project will benefit the neighbouring community and small entrepreneurs in terms of employment and business opportunities.[89] The application for the SCS certificate then goes through the detailed technical examination stage, which includes regulatory, financial, economic and technical aspects of the smart city project. The EDB may issue a letter of intent to the smart city company with specific terms and conditions where it is satisfied that the smart city project meets the requirements of the SCS Regulations.[90] The letter of intent enunciates the conditions to be met for the SCS certificate to be issued and this letter has a validity of 18 months.[91]

The smart city company must apply for the required permits (BLUP, Land Conversion Permit) and licences through the EBD One Stop-Shop.[92] The Land Conversion Permit[93] is necessary where a company has a letter of intent for a smart city project which is being planned on agricultural land. When the smart city company has obtained all the necessary permits and licences and complied with the terms and conditions specified in the letter of intent, the EDB may issue a SCS certificate to the smart city company.[94]

When a company gets a SCS certificate it is responsible for implementing all the components of the smart city project in a timely manner as approved by the EDB.[95] A SCS certificate will lapse and cease to have effect if the development of the smart city has not physically started within two years of the date of the issue of the certificate.[96] Once every three months the smart city company must report on the progress of the work

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man-made drains, any environmentally sensitive areas (ESAs), and any bad neighbour (e.g. a stone-crushing plant, poultry farms). EDB *SCS Guidelines* 16.

88 Regulation 5(2)(c) of the *SCS Regulations*. The smart city developer must submit a social impact assessment report evaluating the impacts of the proposed smart city on the quality of life of the communities who may be affected by the project. Another social obligation of the promoters of smart city projects is the contribution of Mauritian Rupees (MUR) 25,000 for the sale of every residential unit or serviced plot to a social fund to be set up as a SCS social fund under the *Finance and Audit Act* 38 of 1973. See EDB *SCS Guidelines* 16 and 31.

89 See reg 9(2)(c) of the *SCS Regulations*.

90 Regulation 9(4) of the *SCS Regulations*.

91 EDB *SCS Guidelines* 18.

92 EDB *SCS Guidelines* 19. See Part B of the First Schedule of the *Environment Protection Act* 19 of 2002 (the EPA) for the list of undertakings requiring an environment impact assessment (EIA) licence.

93 The Ministry of Agro Industry and Food Security authorises the conversion of agricultural land to non-agricultural use (s 28 of the SIEA, as amended).

94 Regulation 9(5) of the *SCS Regulations*.

95 EDB *SCS Guidelines* 29.

96 Regulation 9(6) of the *SCS Regulations*.

and the general implementation of the project to the SCS Technical Committee.[97]

4.1.1.3 Obligations regarding the sale of bare land/serviced land/residential properties in a smart city

The smart city company has specific conditions to respect regarding the sale of bare land, serviced land for business purposes and residential properties in the smart city.

A smart city company issued with a SCS certificate may sell bare land or serviced land to a smart city developer.[98] The total area of all plots of serviced land must not be more than 25% of the land area planned for the construction of residential properties.[99] A smart city company or a smart city developer may sell plots of serviced land to construct residential properties if the leisure amenities included in the project are available.[100] In the case of serviced land for business purposes, a company which has been granted a SCS certificate can sell serviced land to another company to develop part of the smart city project. Where a company has a non-citizen as a shareholder, it must apply to the EDB for approval to purchase an immovable property under the *Non-Citizens (Property Restriction) Act*.[101]

At least 25% of the residential properties of the smart city are required to be sold to citizens of Mauritius or members of the Mauritian Diaspora registered with the EDB under the Mauritian Diaspora Scheme (MDS).[102] Further, the smart city company or developer is required to submit every three months a report on the sales of residential units and residential serviced land effected to Mauritians and members of the Mauritian diaspora.

The deed of sale must contain standards for construction works verified by an independent quality assurance contractor, who must provide a clearance certificate to the buyer when the immovable property is

97 EDB *SCS Guidelines* 29.

98 Serviced land refers to land where all infrastructural works including roads, walls, landscaping and utility services have been completed. EDB *SCS Guidelines* 32-33.

99 Each plot of serviced land should not exceed 2 100 m^2 in area. EDB *SCS Guidelines* 35.

100 EDB *SCS Guidelines* 35.

101 *Non-Citizens (Property Restriction) Act* 22 of 1975.

102 This scheme targets incentives for the return of the dispersed Mauritian Diaspora community. EDB *SCS Guidelines* 35. See MDS 2023 http://www.diaspora.mu/. Persons eligible to acquire residential property or units or any other part of a hotel are a non-citizen; a citizen of Mauritius; a company registered as a foreign company under the *Companies Act* 15 of 2001; a societé, where its deed of formation is deposited with the Registrar of Companies; and a trust, where the trusteeship services are provided by a qualified trustee. See reg 19 of the *SCS Regulations*.

delivered.[103] The contractor must obtain from the builder a one year guarantee for an insurance policy against any property damage, a two years' guarantee against damage caused by defects affecting non-structural elements of the property and a ten years' guarantee for property damage affecting structural elements of the property.[104] The owner of a residential property in the smart city may resell or transfer the property but is required to inform the CEO of the EDB in writing thirty days before the sale.[105]

4.1.1.4 Permanent residency incentives for non-citizens

A residence permit in accordance with the *Immigration Act*[106] may be granted to a non-citizen who acquires a residential property which costs not less than USD 375 000 or the equivalent in Mauritian currencies or other currencies.[107] A non-citizen who wishes to purchase a residential property under the SCS may apply to the EDB through the smart city company.[108] The residential property is deemed to be acquired on its registration and payment of the fixed duty of 5% of the value of the property to the Registrar General.[109] Non-citizens may acquire any type of residential unit in the smart cities and if the residential property satisfies the minimum amount, the non-citizen may qualify for a residence permit.[110]

However, a non-citizen who acquires a plot of serviced land shall not be eligible to apply for a residence permit unless the construction of a residential property has been completed on that plot.[111] Permanent residency is granted to non-citizens while the non-citizen holds the residential property under the SCS.[112] The residency will be terminated if the person nominated by the SCS company's secretary, director, *gérant* or qualified trustee, general partner and council of the entity informs the EDB to do so.[113] The SCS Regulations and the SCS Guidelines also provide for fiscal and non-fiscal incentives for smart city companies to encourage investment in such projects.

103 EDB *SCS Guidelines* 42.
104 EDB *SCS Guidelines* 42.
105 EDB *SCS Guidelines* 46.
106 *Immigration Act* 13 of 1970; reg 21 of the *SCS Regulations*.
107 EDB *SCS Guidelines* 44.
108 Regulation 18(1) of the *SCS Regulations*.
109 EDB *SCS Guidelines* 44.
110 EDB *SCS Guidelines* 44.
111 EDB *SCS Guidelines* 44-45.
112 EDB *SCS Guidelines* 45.
113 EDB *SCS Guidelines* 45.

4.1.1.5 Fiscal and non-fiscal incentives

A smart city company which has a SCS certificate is exempted from income tax for eight years from the time the SCS certificate has been granted if the income comes from an activity concerning the development, sale, rental or management of immovable property.[114]

Taxes from which a developer may be exempted include the land transfer tax and registration duty on the transfer of land into the smart city company for the development of the smart city project if the transferor has shares in the smart city company equivalent to the value of the land transferred.[115] Where the transferor holds shares in the smart city company which are less than the value of the immovable property transferred, the land transfer tax and registration duty will be levied.[116] This levy will concern the difference between the value of the immovable property transferred and value of the shares held by the transferor in the smart city company.[117]

Exemption also includes the land conversion tax for the land earmarked for the development of non-residential components (office and business premises, tourist, leisure and entertainment facilities, renewable energy and green initiatives).[118]

Other incentives include the exemption of customs duty on the import or purchase of any dutiable goods other than furniture to be used for infrastructural works and the construction of buildings in the smart city.[119] Exemption from customs duty on furniture is another incentive to the smart city company if the processing of the furniture amounts to added value of at least 20% of the cost, insurance and freight (CIF) value at import.[120] There will be exemption on the *Morcellement* tax regarding the subdivision of land but the *Morcellement Act* will apply if there is an excision by a smart city company or an excision for the purpose of the transfer of land to a smart city company.[121]

Non-fiscal incentives for a smart city company with a SCS certificate are an annual allowance of 50% of the costs of expenses on renewable energy, energy-efficient equipment or noise control devices, water-efficient equipment and rainwater harvesting equipment.[122] This allowance also

114 EDB *SCS Guidelines* 51.
115 EDB *SCS Guidelines* 51.
116 EDB *SCS Guidelines* 51.
117 EDB *SCS Guidelines* 51.
118 EDB *SCS Guidelines* 51.
119 EDB *SCS Guidelines* 52.
120 EDB *SCS Guidelines* 52.
121 EDB *SCS Guidelines* 52; *Morcellement Act* 28 of 1990.
122 EDB *SCS Guidelines* 52.

applies to pollution control equipment, wastewater recycling equipment, chemical control devices, desalination plants and composting equipment, as well as equipment for sorting and recycling plastic.[123]

The regulatory framework for smart cities also includes national policies, particularly land use policies, which a smart city in Mauritius is required to respect.

4.2 Smart city planning and land use policies

Smart cities must not only respect other planning and building legislation[124] but also policies regarding the use of land that may be impacted on by the setting up of smart cities. The smart city will have to respect the national land use planning policies. A BLUP and a Land Conversion Permit must be granted before the developer of a smart city may obtain regulatory approval to start a smart city project. A smart city project is evaluated in accordance with the 2003 National Development Strategy (NDS),[125] which includes Planning Policy Guidance (PPG) notes covering the future use of land[126] and the Outline Planning Schemes (OPSs) regarding the local planning area of the smart city.[127]

Smart city planning also needs to be in line with the Multi Annual Adaptation Strategy[128] (MAAS) 2006-2015 and the *Sugar Industry Efficiency Act* (SIEA) 20 of 2001, which reorganise the sugar cane sector and the production of energy from sugar cane by-products. Smart cities can be set up only in areas where sugar cane will no longer be cultivated. The MAAS 2006-2015 tries to minimise the impacts of the sugar sector reform and was devised in the context of the phasing out of the preferential treatment guaranteed by the European Community on sugar

123 EDB *SCS Guidelines* 52.

124 The PDA, the *Local Government Act* 36 of 2011, and the *Building Control Act* 9 of 2012.

125 The 2003 National Development Strategy (NDS) provides a national strategy and policy framework which strengthens the 1994 NPDP. Local development plans and planning guidelines for residential, commercial, industrial and hotel development were developed to ensure better land use planning. MESD *Mauritius Environment Outlook Report* 10.

126 Planning Policy Guidelines (PPG) documents are written statements with guidance on particular planning issues and assist developers and local authorities to comply with principles for good design and the location of activities. MESD *Mauritius Environment Outlook Report* 14. See ss 13-20 of the PDA.

127 In 2006 NDS proposals were translated at the local level through the preparation and approval of local development plans with proposals for the physical development of a planning area. These plans apply to a municipal council or district council area and help local authorities to plan, shape and control the use of land in their areas. MESD *Mauritius Environment Outlook Report* 10.

128 The Multi Annual Adaptation Strategy (MAAS) 2006-2015 was devised in the context of the phasing out of the preferential treatment on sugar prices guaranteed by the European Community. Lim Tung *Environmental Law in Mauritius* 193-194.

prices.[129] This policy does not mention climate change, although it targets the maximisation of the energy production of the sugar cane industry with the use of renewable and non-renewable energy sources, which entails climate change mitigation measures.[130]

After having looked into the regulatory framework of smart cities, the following section examines the environmental sustainability of smart cities in Mauritius.

4.3 Smart cities and environmental sustainability in Mauritius

According to the 2015 SCS Guidelines, one of the strengths of a smart city is its ability to increase sustainability and better manage natural resources through the use of smart policies and smart applications,[131] and the 2020 SCS Guidelines require that the design of a smart city includes a combination of smart efforts *inter alia* to protect the environment from degradation.[132] The SCS Regulations require a smart city to be an ecologically sustainable[133] development and that a smart city Master Plan has to focus *inter alia* on sustainability[134] but they do not provide a definition of what "ecologically sustainable" or "sustainability" refers to exactly. The lack of definition of these terms arguably provides discretionary powers to the Mauritian authorities to take decisions regarding what is sustainable or ecologically sustainable. The SCS Regulations nevertheless require measures to be taken and reported by developers of smart cities regarding energy efficiency, autonomous water generation, sustainable waste management and the preservation of natural resources[135] in accordance with the UN perspective on Sustainable Cities.[136] "Ecologically sustainable" will be construed to be similar to "environmentally sustainable" in the context of this analysis, and to include resource efficiency, climate change adaptation and mitigation

129 The Strategic Environment Impact Assessment (SEIA) of the Multi Annual Adaptation Strategy for the reform of the sugar sector (SEA-MAAS) highlights the environmental impacts of land use change and proposes mitigation measures to minimise the effects of the sugar sector reform. RoM *MSINA Report* 60.

130 RoM *MSINA Report* 28-29, 60.

131 BOI *SCS Guidelines* 45.

132 EDB *SCS Guidelines* 56.

133 Regulation 4(b)(iv) in GN 129 of 2015.

134 Regulation 4(a) of the *SCS Regulations*.

135 Regulations 4(b)(i) and 5(2)(d)(ii)) of the *SCS Regulations*.

136 Sustainable cities need investment *inter alia* in "renewable energy sources, efficiency in the use of water and electricity, design and implementation of compact cities, retrofitting of buildings and increase of green areas, fast, reliable and affordable public transportation as well as improved waste and recycling systems": UN "Towards Sustainable Cities" 53*;* Toli and Murtagh 2020 *Frontiers in Built Environment* 6. A vital pillar of a smart city project is to have a smart environment and its ability to increase sustainability and better manage natural resources through the use of smart policies and smart applications. See EDB *SCS Guidelines* 57.

measures, and resilience to disaster to meet the needs of current generations of Mauritians without compromising the right of future generations to meet their SDG.[137] This sub-section of this paper examines how far smart cities improve on energy efficiency and transport, autonomous water generation and efficient use of water, sustainable waste management, resilience to disaster and the preservation of natural resources to address climate change and avoid the loss of biodiversity. It identifies improvements and recommendations to be made by smart cities in Mauritius to improve their environmental sustainability.

4.3.1 Improvements and recommendations regarding energy efficiency

The SCS Regulations specify the voluntary use of "high-performance energy efficiency measures" such as technology products or practices to save operational costs through reduced energy consumption and utility costs.[138] The use of the measures required will contribute towards climate change mitigation if smart city promoters take such energy-efficient initiatives.

It is commendable that smart cities in Mauritius are expected to use a maximum of renewable sources of energy (solar panels on public buildings, wind turbines) and energy management systems or eco-friendly mechanisms, but no standard is specified for energy efficiency.[139] Some smart cities in Mauritius adopt foreign standards such as the Leadership in Energy and Environmental Design (LEED)-Neighbourhood Development (ND) certification[140] with specific requirements regarding the infrastructures in line with the standards imposed by the United States Green Building Council.[141] Only a few smart cities[142] in Mauritius indicate

137 SDG 11 "Make cities and human settlements inclusive, safe, resilient and sustainable" of the 2030 Agenda for Sustainable Development (UNDP *Transforming our World*) targets sustainable cities and communities to achieve long-term benefits.

138 Regulation 5(5) in of the *SCS Regulations*.

139 Smartcity 2022 https://smartcity.press/environmental-benefits-sc/.

140 Moka Smart City indicates the use of the Leadership in Energy and Environmental Design (LEED) standards for energy consumption and its application for the LEED-ND certification (Lexpressproperty 2017 https://www.lexpressproperty.com/en/news-advices/invest/our-files/the-smart-city-scheme/projects-under-the-smart-city-scheme.html). The Savannah Connected Countryside also targets the LEED-ND certification for high environmental quality buildings as well as photovoltaic and hydraulic facilities (Savannah Connected Countryside Date Unknown https://savannah.mu/en/smart-initiatives/).

141 USGBC Date Unknown https://www.usgbc.org/leed; Luxury 2019 https://www.luxury-in-mauritius.com/escape/mon-tresor-smart-city-a-glimpse-into-the-future.

142 Moka Smart City indicates the use of the LEED standards for energy consumption and its application for the LEED-ND certification (Lexpressproperty 2017 https://www.lexpressproperty.com/en/news-advices/invest/our-files/the-smart-city-scheme/projects-under-the-smart-city-scheme.html). The Savannah Connected

the use of energy efficiency standards, while other smart cities need to improve on their energy efficiency efforts to better contribute to climate change mitigation. In view of the imperative of climate change mitigation, energy-efficient buildings, particularly the optimisation of buildings with energy-efficient cooling systems, are also necessary for Mauritius. A list of standards for energy efficiency[143] could be set up for Mauritius. Smart cities management companies could make use of incentives such as exemption from the payment of income tax for eight years for income derived from an activity pertaining to the use of smart energy management technologies to help suppliers of utility services to forecast and manage energy loads.[144]

In order to reduce traffic congestion and the emission of greenhouse gases, the majority of the residential population of a smart city in Mauritius is meant to live and work in the same location. Smart cities are expected to use land with commercial, leisure and residential properties in the same pedestrian-oriented urban environment where transport is limited to the pedestrian and bike paths or smart-ride sharing. Among the smart cities already approved in mainland Mauritius, however, it is mainly the Savannah Connected Countryside, Uniciti and Montebello that will have pedestrian pathways, while the Savannah Connected Countryside and Uniciti will have cycling paths.[145] More efforts to contribute to climate change mitigation through the provision of efficient urban transport are required for the other smart cities.

4.3.2 Improvements and recommendations regarding autonomous water systems

Although smart cities are expected to cater for their own water needs to the extent possible, none of the smart cities provide information on their provision of autonomous or sustainable water systems.[146] Fresh water resources are precious, especially in times of drought, and reservoirs in Mauritius are not full even during the rainy season. Due to climate change

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Countryside also targets the LEED-ND certification for high environmental quality buildings as well as photovoltaic and hydraulic facilities (Savannah Connected Countryside Date Unknown https://savannah.mu/en/smart-initiatives/).

143 See the Mauritian Standard for energy efficient household dishwashers (MSB 2022 http://mauritianstandards.com/ms-2052022-energy-efficiency-energy-labelling-of-household-dishwashers-requirements/).

144 EDB *SCS Guidelines* 54.

145 Medine Date Unknown https://www.medineproperty.com/master-planning-communities/; Savannah Connected Countryside Date Unknown https://savannah.mu/en/smart-initiatives/.

146 Regulation 5(5)(b) of the *SCS Regulations*; BOI *SCS Guidelines* 8; Lexpressproperty 2017 https://www.lexpressproperty.com/en/news-advices/invest/our-files/the-smart-city-scheme/projects-under-the-smart-city-scheme.html; Savannah Connected Countryside Date Unknown https://savannah.mu/en/smart-initiatives/.

and other factors, flash floods and droughts have become more frequent and need to be managed through the identification of flash flood-prone and vulnerable areas and storm-resilient infrastructure.[147] Fifty per cent of domestic water is derived from ground water in mainland Mauritius and the remainder is supplied from surface sources such as reservoirs and rivers.[148]

In the light of the scarcity of freshwater resources, it is recommended that urban planning for smart cities in Mauritius provides for sustainable or autonomous water usage systems, wastewater recycling and rainwater harvesting equipment. Rain-harvesting systems for buildings and residential properties are not compulsory in Mauritius, but encouraging smart cities to be equipped with such systems would contribute to adapting to climate change. However, none of the smart city projects include the requirement of the provision of rain-harvesting equipment for buildings and residential properties.[149] Incentives for a smart city company include an annual allowance of 50% of the costs incurred on expenditure concerning water-efficient plant, rainwater harvesting equipment and systems, desalination plants and wastewater recycling equipment.[150] Only Moka Smart City and the Savannah Connected Countryside indicate that they will adopt waste water treatment and recycling, and the other smart cities do not indicate any method of promoting water use efficiency.[151] Smart cities should make efforts to construct autonomous water usage systems (e.g. desalination plants), to improve the efficient use of water resources.[152]

147 NDRRMC 2020 https://ndrrmc.govmu.org/Pages/NDRRMStrategicFramework.aspx 20, 32.

148 MEPU 2020 https://publicutilities.govmu.org/Pages/Water%20Sector/WRU.aspx#waterIndicators.

149 Lexpressproperty 2017 https://www.lexpressproperty.com/en/news-advices/invest/our-files/the-smart-city-scheme/projects-under-the-smart-city-scheme.html; Savannah Connected Countryside Date Unknown https://savannah.mu/en/smart-initiatives/; Medine Date Unknown https://www.medineproperty.com/master-planning-communities/.

150 BOI *SCS Guidelines* 41.

151 Lexpressproperty 2017 https://www.lexpressproperty.com/en/news-advices/invest/our-files/the-smart-city-scheme/projects-under-the-smart-city-scheme.html; Savannah Connected Countryside Date Unknown https://savannah.mu/en/smart-initiatives/.

152 Lexpressproperty 2017 https://www.lexpressproperty.com/en/news-advices/invest/our-files/the-smart-city-scheme/projects-under-the-smart-city-scheme.html; Savannah Connected Countryside Date Unknown https://savannah.mu/en/smart-initiatives/; Medine Date Unknown https://www.medineproperty.com/master-planning-communities/.

4.3.3 Improvements and recommendations regarding autonomous waste management systems for smart cities

According to the SCS Regulations and the SCS Guidelines, smart cities are expected to the extent possible to have autonomous waste management systems and report on such systems.[153] Importantly, the annual solid waste load in mainland Mauritius reached 510 000 tonnes in 2020, of which 95% were landfilled in the country's unique and saturated landfill.[154] Better environmental sustainability for smart cities in Mauritius definitely includes the adoption of sustainable waste management which promotes the prevention of waste generation and the reuse, recycling and recovery of generated waste with composting policies. A smart city company can benefit from an annual allowance of 50% of the costs incurred on expenditure concerning composting equipment and equipment for shredding, sorting and compacting plastic and paper for recycling.[155] Currently it is mainly the Savannah Connected Countryside which will have recycling bins and a composting project for organic waste.[156] Smart cities could ensure that sustainable waste management and recycling programmes or recovery of generated waste are enforced, while making their residents accountable. It is recommended that smart cities cater for the collection and recycling of electronic waste. At the national level Mauritius does not have a solid waste sorting policy and adequate recycling options yet[157] and the sorting of wastes is currently done on a voluntary basis. However, when Mauritius adopts an integrated solid waste management policy at the national level smart cities will be expected to comply with this policy.

4.3.4 Improvements and recommendations regarding the preservation of the environment and the optimisation of natural resources

Smart cities need to respect the long-term preservation of the environment and natural resources and to respect intergenerational equity, allowing for future generations to maintain access to resources.[158] According to the

153 Regulation 5(5)(b) of the *SCS Regulations*; EDB *SCS Guidelines* 10.

154 Over eight million tonnes of wastes have been disposed at this landfill since 1997. MESWMCC *Annual Report* 8.

155 EDB *SCS Guidelines* 52.

156 Savannah Connected Countryside Date Unknown https://savannah.mu/en/smart-initiatives/.

157 Solid waste is collected by the local authorities, but the Ministry of Environment, Solid Waste Management and Climate Change (MESWMCC) is responsible for the management of solid waste and hazardous waste through its Solid Waste Management Division. Solid wastes are disposed at the Mare Chicose Landfill, the sole landfill on mainland Mauritius. Lim Tung *Environmental Law in Mauritius* 45. The *Waste Management and Resource Recovery Act* 3 of 2023 has been voted in 2023.

158 ITU 2016 https://www.itu.int/en/ITU-T/focusgroups/ssc/Pages/default.aspx; Toli and Murtagh 2020 *Frontiers in Built Environment* 5.

SCS Regulations the development of a smart city project requires "proper management, development and conservation of natural and man-made resources for the purposes of promoting a better environment".[159] Further, the construction of residential properties in a smart city must not exceed 50% of the total land area, in order to respect the natural resources within the boundaries of the city.[160] The application for the SCS certificate must contain a subdivision plan delineating the external boundaries of the land to be divided and the extent of all lots and green areas, any rivers, rivulets, feeders, canals or man-made drainage systems crossing or adjoining the site.[161] Any environmentally sensitive areas (ESAs) located within 200 metres of the site[162] must be indicated in the project plan. A smart city project must respect any building or site designated as national heritage under the *National Heritage Fund Act* 40 of 2003. In order to have green spaces in sustainable cities, creative ways to maintain or create green spaces must be developed in the initial planning. Before obtaining an EIA licence the smart city company will have to respect the EPA and other environmental policies,[163] environmentally sensitive areas,[164] climate change-related policies[165] and disaster management-related policies.[166] The EIA report of the smart city company will have to include a vulnerability assessment and proposed adaptation measures with respect to climate change.[167] Environmental sustainability also entails building resilience to severe weather events and disasters. The NDRRM Policy and the Strategic Framework and Action Plan 2020-2030 incorporate

159 Regulation 4(b)(iii) of the *SCS Regulations*.

160 See reg 5(2)(d)(ii)) of the *SCS Regulations*.

161 As per the *Cadastral Survey Act* 22 of 2011 and the *Forests and Reserves Act* 41 of 1983.

162 EDB *SCS Guidelines* 16.

163 The EPA; MESWMCC 2022 https://environment.govmu.org/DocumentsList/Masterplan%20for%20the%20Republic%20of%20Mauritius.pdf; RoM 2006 https://www.cbd.int/doc/world/mu/mu-nbsap-01-en.pdf; MAIFPS *National Strategy and Action Plan for Invasive Species*; RoM *Fourth National Report*; MESWMCC 2022 https://environment.govmu.org/DocumentsList/Report%20%20on%20Circular%20Economy%2014.10.22.pdf.

164 MAIFPS *STUDY 3*; MESD *Environmentally Sensitive Areas Classification Report*; MESD *Development of an Integrated Coastal Zone Management Framework*; RoM *National Report on the Implementation of the Ramsar Convention*; MESD *Policy Guidance for Environmentally Sensitive Areas*; MESD *Guideline on the Content of an Environment Impact Assessment Report*.

165 RoM *Third National Communication*; RoM *Long-Term Energy Strategy;* RoM *Energy Strategy Action Plan;* GoM *Outline on Energy Policy;* Maxwell Stamp PLC *Renewable Energy Management Master Plan;* MEPU *Renewable Energy Roadmap.*

166 NDRRMC *National Disasters Scheme*; GoM *National Disaster Risk Reduction and Management Policy*.

167 Section 30(3) of the *Climate Change Act* 11 of 2020.

generally accepted good practice pertaining to disaster risk reduction and management.[168]

In terms of the preservation of the environment, all the approved smart cities respect the provision that construction of residential properties may take place on not more than 50% of the total land area to respect the natural resources within their boundaries.[169]

Although an EIA is required for a smart city project, given the fast-track procedure to obtain the necessary licences and permits (through the EDB Business Facilitation One-Stop Shop), a full evaluation of the possible environmental and socio-economic impacts may arguably not be possible.[170] It is recommended that a Strategic EIA (SEIA) be required for a smart city project with the mitigation of its environmental effects since the impacts assessed by an EIA may be too restrictive.[171] A SEIA should be required for a smart city project to better evaluate the environmental and socio-economic impacts of the project. For example, in the RNSC application,[172] there are ESAs (wetlands, forests, marshes and caves) situated in the 358-ha area where the hotel of 90 luxury villas (phase 1) and a smart city (phase 2) will be developed. The promoter of the RNSC project had to submit another EIA report after its first EIA report was set aside by the Ministry responsible for the environment. A SEIA is necessary to consider all the impacts of the construction of the proposed hotel and villas, the impacts of the project on the wetlands/marshes, on the neighbouring villages and on the lives of their inhabitants.[173] Another recommendation regarding an EIA is that the enforcement of conditions for the EIA licence of smart cities should be strengthened with strict adherence to relevant planning guidelines and legislation being required.

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168 NDRRMC 2020 https://ndrrmc.govmu.org/Pages/NDRRMStrategicFramework.aspx.

169 Lexpressproperty 2017 https://www.lexpressproperty.com/en/news-advices/invest/our-files/the-smart-city-scheme/projects-under-the-smart-city-scheme.html; Savannah Connected Countryside Date Unknown https://savannah.mu/en/smart-initiatives/; Medine Date Unknown https://www.medineproperty.com/master-planning-communities/.

170 Regulation 6(8)(a) of the *SCS Regulations* and s 21(4)(a) of the EDBA.

171 BOI *SCS Guidelines* 15-17.

172 Public comments were submitted by the non-governmental organisation (NGO) Platform Moris Lanvironnman (PML) in April 2022 requesting a SEIA on the whole site instead of an EIA. The promoter of the project, PR Capital, submitted the first EIA report in April 2022, which targeted only part of the Roches Noires Smart City (358 ha) and which concerned a hotel on 44 ha of land. PR Capital 2022 https://business.edbmauritius.org/publiccomments/api/application/register/EIA/ENV-ESDD-EIA-2022-3/document/%7BAF75E20B-BA2B-4417-9D91-3E5CA3E44146%7D.

173 PR Capital 2022 https://business.edbmauritius.org/publiccomments/api/application/register/EIA/ENV-ESDD-EIA-2022-3/document/%7BAF75E20B-BA2B-4417-9D91-3E5CA3E44146%7D.

In order to better optimise the use of land resources, the smart cities could promote urban agriculture and food production where possible, since many of them are being established on what was prime agricultural lands. The release of prime agricultural land must be carefully planned, taking into consideration food security after the Covid 19 pandemic and the consequences of the armed conflict between Ukraine and Russia. Food security is a key concern for Mauritius, and it is recommended that different aspects of urban farming be incorporated in smart cities to grow food for personal consumption and through communal gardening.

After having made recommendations for the improvement of the development of smart cities in Mauritius in view of better environmental sustainability in the context of land use planning, other general recommendations are as follows. A legal definition of "sustainability" and "ecologically sustainable" is necessary for the better realisation of these goals. Since the SCS Guidelines indicate that the smart city concept could apply to existing sites[174] and cities, the smart city concept could apply to existing cities as well, to make them more environmentally sustainable. In order to enhance the governance of sustainability[175] for smart cities, they could include citizenship participation regarding air quality monitoring, energy use optimisation, water use efficiency, and waste tracking. Environmental sustainability for a smart city could also entail the use of air pollution standards or sensors to measure air pollution levels. The main environmental benefits of smart cities in Mauritius according to the SCS Regulations will be energy efficiency, sustainable water generation, autonomous waste management, and the sustainable use of environmental resources, if more efforts are made by the smart city companies and if there is proper monitoring of implementation.

5 Concluding remarks

While sustainable and coordinated urban development is important for Mauritius, most weight seems to be placed on investment promotion with the application of permits and licences to be facilitated and fast tracked through the Investment Projects Fast-Track Committee/EDB One-Stop Shop.[176] The smart city concept for Mauritius encourages the development of land into coordinated urban planning, but since Mauritius has limited land resources, it is of the utmost importance that the establishment of smart cities is environmentally sustainable.

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174 Provided they meet the set criteria and requirements of the Scheme. BOI *SCS Guidelines* 8.

175 Governance for sustainability is defined as "the set of written and unwritten rules that link ecological citizenship with the institutions and norms of governance". Bosselmann, Engel and Taylor *Governance for Sustainability* xiv.

176 EDB *SCS Guidelines* 52; Lim Tung *Environmental Law in Mauritius* 299.

Environmental sustainability is mentioned in the SCS Regulations, but the lack of a definition does not help to implement environmental sustainability in smart city projects. Legal definitions of "sustainability" and "ecologically sustainable" would help towards the better implementation of these terms. If the conversion of agricultural land is essential to diversify the sugar industry after the dismantling of the *Sugar Protocol*, the optimisation of land resources is necessary. The release of prime agricultural land requires better planning to the extent that land resources are limited in the country. A SEIA could help to better evaluate the environmental impacts of a smart city project and prepare mitigation measures accordingly. Smart city projects must be carefully planned and limited in number. Yet, while there are twelve main cities in mainland Mauritius, twelve smart cities in different phases of completion have been approved in mainland Mauritius from 2015 to 2021, and other such projects are seeking regulatory approval.

Most smart cities in Mauritius are newly established towns. Smart city elements are not being integrated in existing cities. The SCS Guidelines indicates that the smart city concept could apply to existing cities as well, but it remains to be seen which cities could be chosen to be converted into smart cities.

Energy efficiency, water use management and efficiency, sustainable waste management and environmental resource preservation and optimisation are the proposed main environmental benefits of smart cities in mainland Mauritius. Indeed, smart cities could contribute to reducing greenhouse gas emissions with the use of renewable sources of energy, energy efficiency and better transport, but monitoring is important for effective implementation and adequate enforcement. Enforcement mechanisms and strict adherence to planning guidelines and legislation should be strengthened for smart city projects.[177] Environmental sustainability could be improved and should be monitored, specially through an adequate governance system involving the participation of the inhabitants of the smart cities.

Sustainable urban development is important for Mauritius but twelve smart cities have already been approved and other smart cities are in the process of being approved, which are more than enough for a SIDS. Given the consequences of the Covid 19 pandemic and of the armed conflict between Ukraine and Russia, Mauritius has other priorities than rapid urban development to take into consideration. The need for national decision-makers to carry out an appropriate balance of interests in

177 MESD *Maurice Ile Durable Policy, Strategy and Action Plan* 14.

development projects in view of sustainable development cannot be overstated.

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List of Abbreviations

ACP	African Caribbean Pacific
ACP-EU	African Caribbean Pacific-European Union
BOI	Board of Investment
BLUP	Building and Land Use Permit
CEO	Chief Executive Officer
CEU	Council of the European Union
CIF	cost, insurance and freight
CSO	Central Statistics Office
DCG	Department of Cooperative Governance
EDB	Economic Development Board
EDBA	Economic Development Board Act 11 of 2017
EIA	environment impact assessment
EPA	Environment Protection Act 19 of 2002
ESAs	environmental sensitive areas
ETSI	European Telecommunications Standards Institute
EU	European Union
GoM	Government of Mauritius
ICT	information and communication technology
IHS	Invest Hotel Scheme
IPA	Investment Promotion Act 42 of 2000
IRS	Integrated Resort Scheme
ISO	International Standards Organisation
ITU	International Telecommunication Union
LEED	Leadership in Energy and Environmental Design
LEED-ND	Leadership in Energy and Environmental Design Neighborhood Development
MAAS	Multi Annual Adaptation Strategy
MAIFPS	Ministry of Agro Industry, Food Production and Security
MDS	Mauritian Diaspora Scheme
MEPU	Ministry of Energy and Public Utilities
MESD	Ministry of Environment and Sustainable Development
MESWMCC	Ministry of Environment, Solid Waste Management and Climate Change

MID	Maurice Ile Durable
MS	Mauritian Standards
MSB	Mauritian Standards Bureau
MSINA	Mauritius Strategy for Implementation National Assessment
MTSCCL	Mon Trésor Smart City Company Ltd
MUR	Mauritian Rupees
NBSAP	National Biodiversity Strategy and Action Plan
NDRRM	National Disaster Risk Reduction Management
NDRRMC	National Disaster Risk Reduction and Management Centre
NDS	National Development Strategy
NGO	non-governmental organisation
NPDP	National Physical Development Plan
OPS	Outline Planning Scheme
PDA	Planning and Development Act 32 of 2004
PML	Platform Moris Lanvironnman
PPG	Planning Policy Guidance
REDS	Real Estate Development Scheme
RES	Real Estate Scheme
RNSC	Roches Noires Smart City
RoM	Republic of Mauritius
SCS	Smart City Scheme
SDG	Sustainable Development Goal
SEIA	Strategic Environment Impact Assessment
SIDS	small island developing State
SIEA	Sugar Industry Efficiency Act 20 of 2001
SMEs	small and medium enterprises
TCPA	Town and Country Planning Act 6 of 1954
UN	United Nations
UNDP	United Nations Development Programme
USD	United States dollar
USGBC	United States Green Building Council