Assessing Sustainability In Mauritius

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Abstract: The primary purpose of this study is to find out the sustainability level in Mauritius. The study also focused on the CSDI model to some extend to get an idea on how sustainability is assessed at company level. Nevertheless, in our case, we have tried to extend this concept to country level. Moreover, raw data were collected from the Central Statistic Office and all the computation was carried out through the model Furthermore, the results revealed that Mauritius is a sustainable country, but there is still more room for improvements and that we are not very far from becoming a model sustainable country for many developed countries across the world. Finally, the sustainability index has been carried out using a scenario analysis method which revealed that sustainability is applied to in Mauritius

Keywords: Sustainability, Mauritius, CSDI Model

Introduction

Over the last decades sustainability has become a subject of major concern due to the negative impacts across the globe. National surveys carried out have always revealed that public concern regarding sustainability is high as elucidated by Dixon & Fallon (1989) Moreover, Davis (1960) affirms that Business sustainability is regularly characterized as dealing with the triple bottom line - a methodology by which organizations deal simultaneously with their economic, social and environmental performance. These three effects are now and then alluded to as benefits, individuals and planet as proclaimed by Göran & Beverly (2015). Additionally, stakeholders also put pressure on organisations to be sustainable so that customers feel that the firm does not only care about making money but also caters for the environment and society On the other hand, this methodology depends on an accounting based viewpoint and does not completely catch the time component that is natural inside business maintainability. A more vigorous definition is that business sustainability speaks to versatility over the long run – organizations that can survive stuns in light of the fact that they are personally joined with solid financial, social and natural frameworks as stipulated by Frederick (1960). These organizations make monetary esteem and add to sound biological communities and solid group communities For our study, we are considering the business sustainability for Mauritius. Hence we want to analyse to what extent our Island is sustainable in all the aspects. As a country, we accept that the earth and its kin are to be esteemed and regarded, while attempting to work in a way that grasps natural stewardship and social obligation such that the country will flourish in ceaselessness while adding to the sustainability of the communities in which we live, work and serve. For every project, our state supports decision makers in understanding the master plan, while giving innovative and useful arrangements that adjust monetary, natural, and social targets. They also put holistic approach in propelling a comprehensive approach that encourages coordinated effort, consolidates connection delicate needs, and takes a gander at the general life-cycle expenses and profits.

Problem Statement

Sustainability is a concept that many countries fail to adopt (Göran & Beverly, 2012), especially those who are operating on a 24/7 basis as in the case of our country. Hence, our main concern is to find how the Mauritius is following sustainable measures and providing services to communities. In the same line, Gray (2010) elucidates that Business Sustainability is a relatively emerging field, this is because it is connected to a wide range of of diverse areas such as Organisational Behavior, Business Strategy, operations management, accounting, finance, just to name a few. Therefore, in our case, we are trying to unfold the numerous aspects of business sustainability not yet considered

SIGNIFICANCE OF THE STUDY

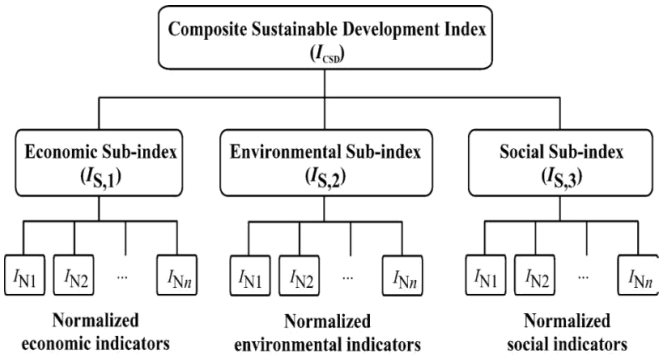
The study is intended towards a bold move in sustainable development in Mauritius. The focus of this legislation is the Maurice Ile Durable agenda - referred to as the MID programme with its intention of turning the island into a model sustainable island.

METHODS AND PROCEDURES

AIM: The main objective of this research is to give an overview of different sustainability evaluation in Mauritius The current research examines and reports how our Island – each committed to economic, social and environmental efforts of business sustainability – implement and manage their "sustainable business models" and applications of sustainable business practices in the marketplace and society. Moreover, the research objective is to describe constituents of business sustainability efforts within the economic, social and environmental categories Lastly, the study aims at probing into different aspects of sustainability and to analyse to what extent we are being sustainable.

Methods and Techniques to apply the model

The model uses normalized triple bottom line indicators to incorporate them into a unique measure of performance. The model could provide a point of reference against which reporting companies



Source; *Krajnc & Glavi(2005)*
Source: *Adapted from Krajnc and Glavic (2005)*

Table 1 *- Process of Calculating sustainability index*

Step 1	Select the indicators
Step2	Group indicators in social, environmental or economic
Step 3	Judge the impact of the indicator (positive or negative)
Step 4	Normalize the indicators
Step 5	Define the weight of the indicators
Step 6	Calculate the Sub-indices
Step 7	Calculate the final value of Sustainability Index (ICSD)

To gauge the indicators, Krajnc and Glavic, (2005) proposes the utilization of an analytic hierarchy process (AHP). This scale is utilized to determine indicator weights in light of prioritization of effect by evaluating the organization's general sustainability. It has solid scholarly acknowledgement and a straightforward application. The proposition gives a scale nine levels. In the wake of characterizing the indicators, the affiliation is performed utilizing AHP scales of correlation between sets of markers. When this methodology is finished, ICSD figuring is driven by the aggregate of positive and negative sub-pointers for each of the three classifications (social, environmental, and economic), totaled into the last pointer of sustainability.

Normalising the Indicators

The main problem of aggregating indicators into the I_{CSD} is that indicators may be articulated in different units. One method to resolve this trouble could be normalizing every indicator i by dividing its value in time (year) t with its average value of all the time in years measured (Eqs. (1) and (2)).

$$I^{+}_{N,ijt} = \frac{I_{A^{+},ijt}}{\bar{I}_{A^{+},ij}} \quad (1)$$

$$I^{-}_{N,ijt} = \frac{I_{A^{-},ijt}}{\bar{I}_{A^{-},ij}} \quad (2)$$

where $I^{+}_{N,ijt}$ is the normalized indicator i (with positive impact) for group of indicators j for time (year) t and $I^{-}_{N,ijt}$ is the normalized indicator i (with negative impact) for group of indicators j for the same time (year) t. The second way could be normalizing each indicator i using Eqs. (3) and (4).

$$I^{+}_{N,ijt} = \frac{I^{+}_{A,ijt} - I^{+}_{min,jt}}{\max I^{+}_{,jt} - \min I^{+}_{,jt}} \quad (3)$$

$$I^{-}_{N,ijt} = 1 - \frac{I^{-}_{A,ijt} - I^{-}_{min,jt}}{\max I^{-}_{,jt} - \min I^{-}_{,jt}} \quad (4)$$

In both methods, the possibility of incorporating diverse kinds of quantities, with different units of measurement (i.e. physical, economic, etc.), is accessible.

Weights computation

Scenario analysis (Peggy, Grant and Simon, 2007) is a procedure of investigating conceivable future occurrences by considering option conceivable results (here and there called "option universes"). Subsequently, the scenario analysis, which is a fundamental strategy for projections, does not attempt to demonstrate one precise picture without bounds. Weights have been computed in terms of priorities using the scenario process as judged by the authors. These weights ought to reflect hierarchies and/or priorities in the opinion of the decision-makers. In the final computation of the I_{CSD}, an approach that utilizes expected weights can be measured. Weights reflect the significance given to the economic, environmental, and social performance of the corporation, correspondingly.

Proposing Performance Indicators

Indicators execute numerous functions. They can direct to enhanced decisions and more efficient measures by simplifying, clarifying and making aggregated data accessible to policy makers. They can help integrate physical and social science facts into decision-making, and they can help compute and standardize progress in the direction of sustainable development goals. They can provide an early caution to prevent economic, social and environmental setbacks. Furthermore, they are useful tools to converse ideas, thoughts and values. Thus, with reference to Max-neef (1991) Human Scale Development, some indicators have been selected in line with the literature review at country level which are measurable, understandable and available.

Table 2: *Definition of the indicators*

	Indicators	Units	Symbol	Description
Environmental	Solid waste generation	Tonnes	SW	Some electricity generation technologies advances bring about the formation of strong waste. This waste is discarded in landfills which contain dangerous and risky components that need special handling, treatment, and disposal.
	Forest area	Hectares	FA	A state forest is a forest that is administered or protected by some agency of a sovereign or federated state, or territory.
	Protected	Hectare	PA	A protected area is a

	area	s		clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve long term conservation of nature.
	Fresh water abstraction – Source	Millimetres	FS	Groundwater extraction can be used for irrigation, industry, recreation, flood control or treatment to produce drinking water.
	Annual rainfall	Millimetres	AR	The amount of water falling in rain, snow, etc., within a given time and area, usually expressed as a hypothetical depth of coverage.
	Wastewater treatment plant	Millimetres	WP	Structures and appurtenances which receive the discharge of a sanitary drainage system and which are designed to e.g., a septic tank or cesspool.
	Threatened plants	%	TP	The number of plants which are in danger of extinction
	GHG emissions per capita	Tonnes	GHG	Per capita GHG Emissions is a measure of greenhouse gas emissions per person in each country.
Economic	Electricity production	GWh	EP	Electricity generation is the process of generating electric power from other sources of primary energy.
	Criminal cases	Number	CC	A court proceeding in which a person who is charged with having committed or omitted an act against the community or state is brought to trial and either found not guilty or guilty and sentenced.
	Gini index	Rs Million	GI	A measurement of the income distribution of a country's residents. This number, which ranges between 0 and 1 and is based on residents' net income, helps define the gap between the rich and the poor, with 0
	Government Expenditure for Social Services	Rs Million	SS	Government spending or expenditure,on goods and services for current use, to directly satisfy the individual or collective needs of the community,
	Unemployment	Per 1000	U	Unemployment is defined as a situation where someone of working age is not able to get a job.
	Resource balance	Rs Million	RB	The difference between the number of imports and exports
	Exports	Rs Million	E	To ship (commodities) to other countries or places for sale, exchange.
	Public health expenditure	Rs Million	PHE	Public expenditure on health including publicly-financed investment in health facilities plus capital transfers to the private sector for hospital construction and equipment.
	Public expenditure on education	Rs Million	PEE	Public expenditure on educational institutions (both public and private), education management as well as subsidies for private entities (students/households and other privates entities).
Social	Life expectancy (years) at birth	Years	LE	Life expectancy pertains to the age-specific mortality rates of a given period.
	Ratio of students to teaching staff in secondary schools		RS	The number of students who attend a school or university divided by the number of teachers in the institution.
	Net enrollment ratio: primary & secondary	Rs Million	NEPS	The ratio of primary v/s secondary school enrollment
	Infant mortality rate	per 1000 live births	IM	The infant mortality rate is an estimate of the number of infant deaths for every 1,000 live births. This rate is often used as an indicator to measure the health and well-being of a nation.
	Mortality from respiratory diseases	per 1000 live births	MD	Death caused by respiratory disease which is a medical term that encompasses pathological conditions affecting the organs and tissues.

Accordingly, 9 Economic, 5 Social and 8 Environmental indicators have been proposed as per the literature review from a country based approached. The indicators have been tabulated as shown below All the indicators have been separated in the three sustainability parts and all the data have been collected from the Central Statistic Office website. Additionally, the blank cells are due to unavailability of data in some cases. This has been compensated by using the mean of each indicator to normalize them.

Table 3 *- Normalised Economic Indicator*

Economic indicators

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Criminal cases	0.55	0.63	0.74	0.89	1.00	1.13	1.41	1.14	1.01	1.03	1.07	1.03	1.15	1.22
Gini index	0.56	0.62	0.67	0.74	0.83	0.87	0.98	1.15	1.27	1.29	1.39	0.00	1.65	0.00
State Expenditure for Social Services	0.70	0.78	0.91	1.00	1.08	1.17	1.28	1.34	1.45	0.49	1.01	0.84	0.91	1.04
Unemployment	0.76	0.81	0.86	0.94	1.04	1.21	1.16	1.09	0.94	0.97	1.06	1.00	1.09	1.06
Exports	0.64	0.74	0.84	0.83	0.86	0.99	1.15	1.09	1.06	0.96	1.08	1.15	1.24	1.37
Public health expenditure	0.46	0.52	0.58	0.64	0.76	0.80	0.85	0.89	0.95	1.18	1.56	1.48	1.57	1.76
Difference between import and export	0.32	0.24	0.24	0.29	0.49	0.68	0.94	1.17	1.46	1.29	1.57	1.69	1.85	1.76
Public expenditure on education	0.24	0.26	0.29	0.34	0.37	0.41	0.41	0.43	0.53	0.58	0.61	0.70	0.75	8.09
Electricity production	0.75	0.80	0.82	0.88	0.91	0.95	0.99	1.04	1.07	1.08	1.13	1.16	1.19	1.23

Table 4 *- Normalised Social Indicator*

Social indicators														
	2003	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Ratio of students to teaching staff in secondary schools	1.18	1.12	1.12	1.06	1.06	1.00	1.00	1.00	1.00	0.93	0.93	0.87	0.87	0.87
Net enrolment ratio: primary & secondary	0.97	0.98	0.98	1.00	1.00	1.01	1.02	1.02	1.02	1.02	1.00	0.00	0.00	0.00
Infant mortality rate	1.14	1.03	1.07	0.92	1.03	0.95	1.01	1.10	1.03	0.96	0.96	0.90	0.92	0.98
Life expectancy	0.99	0.99	0.99	0.99	0.99	0.99	1.00	1.00	1.00	1.01	1.01	1.01	1.01	1.02
Mortality from respiratory diseases	1.10	1.07	1.01	1.05	0.96	1.09	0.96	0.82	0.80	1.05	1.05	0.98	1.06	0.00

Table 5 *Normalised Environmental Indicator*

Environmental indicators														
	2005	**2006**	**2007**	**2008**	**2009**	**2010**	**2010**	**2011**	**2012**	**2012**	**2013**	**2014**	**2015**	**2016**
Greenhouse Gas emissions per capita	0.09	0.09	0.10	0.10	0.10	0.10	0.11	0.11	0.11	0.10	0.12	4.21	4.25	4.41
Solid waste generation	0.71	0.81	0.90	0.97	1.00	1.00	1.07	1.03	1.05	1.09	1.13	1.09	1.02	1.13
Threatened plants	0.00	0.00	0.00	0.00	0.98	0.99	1.12	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Forest area	1.14	1.14	1.14	1.14	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.94
Protected area	0.01	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	4.31	4.31	4.31
Fresh water abstraction – Source	0.96	0.96	1.03	1.03	1.03	0.98	0.97	0.89	0.88	0.90	0.90	1.07	1.14	1.26
Annual rainfall	0.79	0.73	0.84	0.87	0.90	0.97	0.80	0.80	0.96	0.98	0.77	1.59	1.32	1.68
Waste water treatment plant	0.75	0.76	0.76	1.13	1.09	1.13	1.32	0.90	0.95	0.92	1.29	0.00	0.00	0.00

Results and Discussion

Regrouping the performance indicators into positive and negative impacts

The indicators have been identified as having a positive or negative impact at country level hence have been regrouped together.

Table 6 *- Positive v/s Negative indicators*

Economic indicators	
Positive	**Negative**
GI	CC

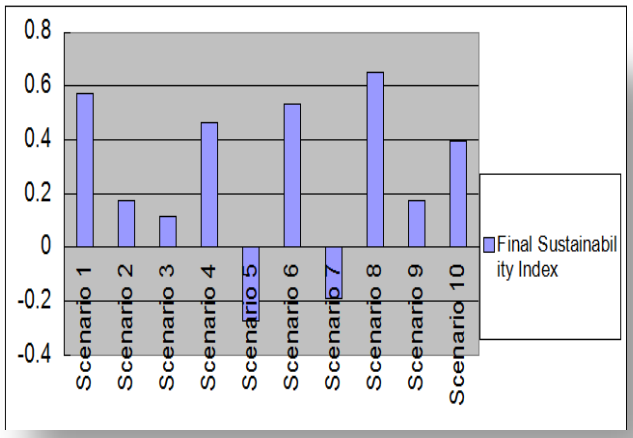
SS	U
E	
RB	
PEE	
EP	
PHE	
Social indicators	
Positive	**Negative**
RS	IM
NEPS	MD
LE	
Environmental indicators	
Positive	**Negative**
FA	GHG
PA	SW
FS	TP
AR	
WP	

A Scenario Analysis has been used 10 times to determine the weights of the performance indicators and hence avoid any discrepancy with present and future analysis. The author/s has also come up with the criteria that the weights should lie between 0 to 0.5, that is, 0 < weights ≤ 0.5 in order to prioritize the indicators bounded by these figures. Furthermore, the total aggregate of the 22 weights are to be totaled to 1. In turn, the weights has been multiplied against each normalized value and the summation of each indicator is calculated as shown in table below. Finally, the average of all the values for the 13 years have been cumulated so as to non-dimensionalize the values. to gauge the country sustainability criterion, the author /s has also derived a Sustainability indices cross check table

Table 7 *- Sustainability indice*

Unsustainable	Sustainable	
	Weak	Strong
≤0	> 0 but ≤ 0.5	≥ 0.5

This criterion has been enthused from Dow (1999) which tracks the stock performance of the world's top firms in terms of economic, environmental and social criteria. However, this criteria is extended to a global level instead of being restricted at company level The final sustainability index has been calculated by the difference between the positive and negative indicators. Hence the results of the scenario analysis are shown in Table 12 which connote that, there are 5 weak, 2 unsustainable and 3 strong impacts as derived from the criteria in Table 7. Furthermore, Figure 1, demonstrates the flow of the sustainability indices whereby in each of the scenario sustainability regime, we have analysed the relationship between the positive and negative factors affecting our sustainability. In this context, we have deduced that the economic and environmental indicators have a superior role to play in our model of sustainability and that there is a degree of correlation between economic and environmental indicators.



Conclusion

This study is a snap-shot of the current sustainability assessment in Mauritius. It has been an effort to present, analyse and assess sustainability in terms of the triple bottom line method. In doing so, the results gathered showed that, our current endeavour to be a sustainable country is to some extent fair as the scenario analysis displayed. Furthermore, we also acknowledge that such a complex phenomenon can never be perfect as there are always assumptions and discrepancies while carrying out this assessment (Epstein and Roy, 2001), nevertheless; the model represents a fair measure to evaluate sustainability at country level. While sustainability data is commonly treated independently, this paper tries to make an interpretation of it into a shape that relates to the needs of decision takers. The paper represents that it is conceivable to survey the feasible advancement in an incorporated way which ultimately gives great direction in decision making. At present, the contents of sustainability reports has a tendency to show up in structures and units that are not promptly convertible into a measurable one, however, the model used attempted to demonstrate a technique for normalizing data

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