More Synchrotron Light for Latin America in the Greater Caribbean?

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Greater Caribbean

Basic definition: **Central America and Caribbean countries**

- In this talk: Mexico, SICA countries (continental Central America and Dominican Republic), Colombia, Caribbean islands

- Geographically broader: Venezuela, Cuba, Puerto Rico, and five US states:Texas, Louisiana, Alabama, Mississippi, and Florida.

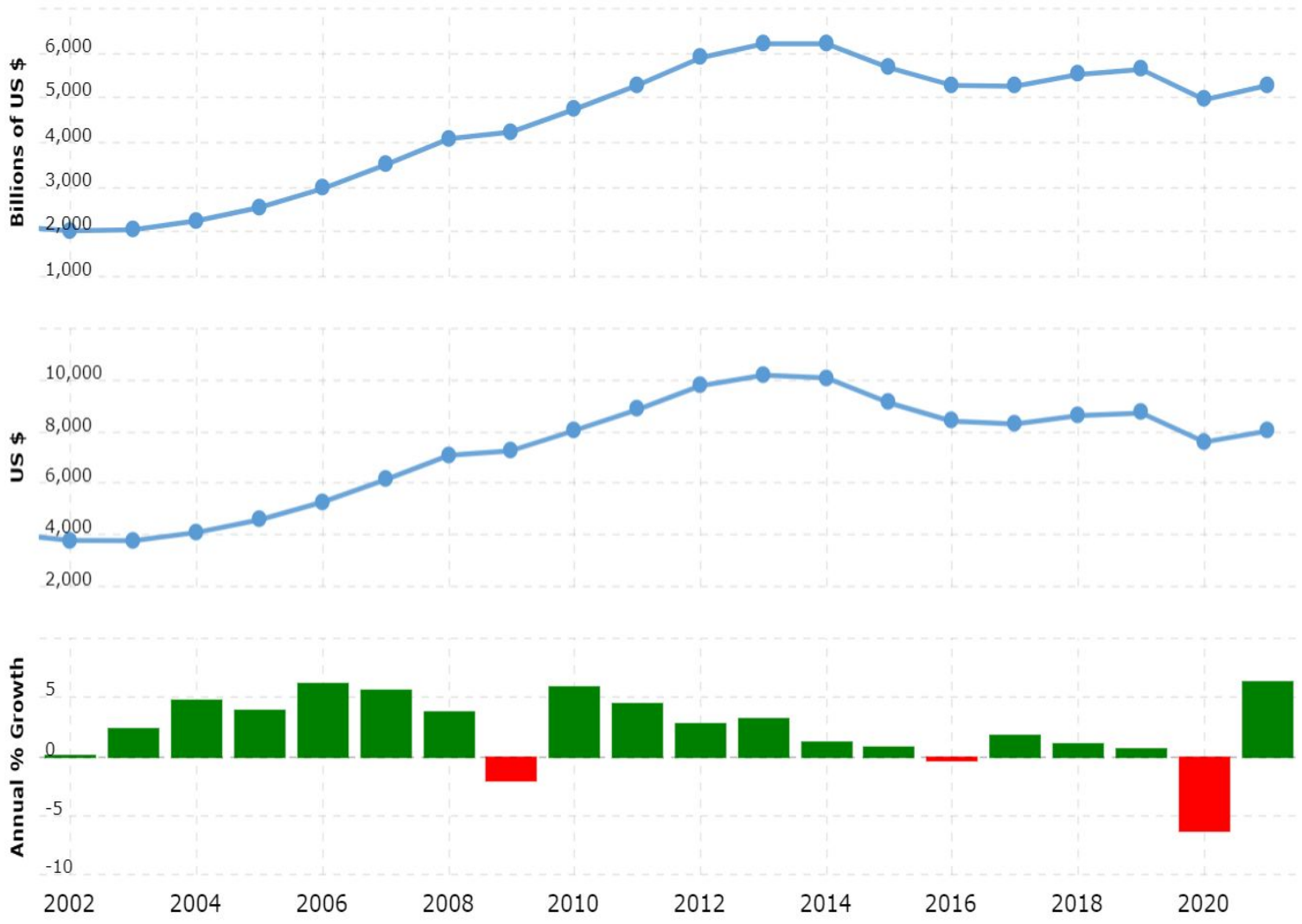
GC typical economic Matrix

- Explotation of Natural Resources
- Agriculture
- Tourism
- Trade – Internal economies
- - Services
- Migrant Remittances
- Import of technological goods

A need: High Technology industry

Latin American Economies

https://www.macrotrends.net/countries/LCN/latin-america-caribbean-/GDP-gross-national-product'>Latin America & Caribbean GDP 1966-2022



LA vs US Higher Education and Science

- Universities: 1538 Santo Domingo
  1562-1676 Guatemala City
  1636 Harvard
  1792 Rio de Janeiro

- Science: Yale Chemistry 1804
  Latin America, XXth Century
  Role of migrations: in the ’30-ies (Nazi - Fascist antisemitic laws and Spanish Civil War)
  in the ‘70-ies (Southern Cone dictatorships)

- R & D Expenditure: Latin America 0.6% GDP (Brasil 1.2%, Argentina 0.46 %, Guatemala 0.04%)
  US 3.45%

- Political perception: US V. Bush, Science, The Endless Frontier, 1945
  Space race ‘60-ies
  LA Economic Matrix,
  Opportunity cost, Fiscal austerity

Science in Greater Caribbean (2018)

Country	Res/1000 labor force (%) 2018 (year)	HEExp/GDP	Ph D students (%)	Publications	R & D/GDP
Mexico	0.71	1.02	43774	23508	0.31
Colombia	0.17	1.05	6225	11193	0.24
SICA countries					
Guatemala	0.03	0.41	881 (2017)	269	0.03
Belize*					
El Salvador	0.15	0.33	63	69	0.16
Honduras	0.08	0.88	492 (2017)	181	0.04
Costa Rica	0.79	1.36	2805 (2019)	1053	0.39
Nicaragua				118	
Panama	0.08	1.1	107 (2016)	727	0.15
Dominican Rep.				232	

* not considered by UNESCO Science Report becase included in the Caricom section.

Sources: UNESCO Science Report 2021 (Gabriela Dutrénit, Carlos Aguirre, Martín Puchet Mónica Salazar) and Carlos Aguirre, private communiation

Bottlenecks- 1st : S & T Funding

- GDP % is a poor indicator when population less than 10-15 millon, and/or low per capita income.
- Low investment in S & T
- **Impossibility of investing in big national scientific programs. Need of Regional Programs and Funding**

Funding sources:

- National public financing (**very little, if any, private**)

- International financing – Development Banks, usually earmarked for specific projects in specific areas, not allowing structural actions

- Cooperation - often treated as a primary source and not as a complementary one, constraints on eligibility of the research object.

A Regional Fund Proposal: FORCyT
Interesting, but sleeping

First suggestion: GV, June 2015, CSUCA meeting in Cartagena, presented to Guatemala Government by J.A. Fuentes Soria, CSUCA ‘s SG .

Endorsement by Guatemala Government (again J. A. Fuentes Soria, as Vicepresident) at a SICA Meeting, El Salvador, December 2015, 25M$/year during 5 years

CTCAP Meeting in Guatemala (September 28, 2016)

Still waiting for the decision of the Heads of State

Fuentes Soria, J. A. (2017), “Fondo Regional de Ciencia y Tecnología del Sistema de la Integración Centroamericana, FORCYT-SICA” in Lemarchand G., Relevamiento de la investigación y la innovación en la República de Guatemala, Paris, UNESCO

Bottlenecks- 2nd : Science Policy Goals

"It is very common in backward countries an inordinate concern for immediate applications, and therefore it is customary to boast of practical judgment and to call for research exclusively of **immediate application and useful to society.**“ Bernardo Houssay, 1954

Bottlenecks- 3rd : Two Myths

Socially useful science (myth of the seventies)

Forgotten the possibility of unsuccessful projects (Old article of Émile Borel)

Usefulness of useless (Nuccio Ordine)

Modern variant: mantra of **innovation**, neglecting the need of adequate technological and scientific background (David Gross's Chain of impossibilities: ESTI)

Synchrotrons in the World

LA large Science Infrastructure

Astronomy & Astrophysics:

Chacaltaya Lab in Bolivia, 1942 (1947 pion discovery)

La Silla (ESO) and Cerro Tololo (Interamerican) Observatories, 1969

Pierre Auger Observatory (Mendoza, Cronin) 1999

Several current projects, both open-sky (e.g.HAWC, Puebla, Mexico) and underground (ANDES, Argentina- Chile tunnel)

Only one synchrotron

Synchrotrons
Importance and Versatility

Research	Teaching	Society
Nanomaterials	Master & Ph D Thesis	Industrial development
Materials Science and engineering	Technician training	Medical imaging
Chemistry		Radioisotopes
Archaeology	Governance	Minerals
Paleontology	Science Diplomacy	Environment
Geophysics		Climate
Cultural heritage		
Informatics		
Space		

LA (and Caribbean)

Only that at LNLS Campinas: first proposal 1982, VUV (1997), Sirius (2018)

Other Proposals:

Colombia: Bernardo Gómez (2015)

Mexico: first in Morelos (Víctor del Rio, 2015), then Hidalgo

Cuba: After Obama's visit (2016), Jeremy Rothstein and Fidel Castro Smirnov

Puerto Rico – beamline at Cornell

Our Proposal (2021)

Regional Proposal

https://arxiv.org/abs/2109.11979

A Synchrotron as Accelerator of Science Development in Central American and the Caribbean

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Human Capacity in the Region

Potential users

~~Available, especially in sectors where Region's non-scientific~~ demand is high, such as health, food safety, biodiversity.

They must be trained. First need: to broadly explain that main use of synchrotrons is not for physics research.

Not to be forgotten possible demand from outside the Region

Engineers, staff and technicians of the to-be Synchrotron

Little experience, but SESAME's experience shows it is only an apparent problem. When building the facility, enough time to realize a vigorous training program.

Civil engineering is strong

Training

NECESSARY DEDICATED TRAINING PROGRAM

Civil engineers and users do not require a strong effort, Staff and technicians, in particular for what concerns beamlines, sample environment etc. do.

NOT NECESSARILY A REGIONAL PROGRAM.

Possible sharing with sister AfLS Project, through LAAAMP, South-South (SESAME, SIRIUS), North--South cooperation (Elettra?, American synchrotrons?, European synchrotrons, e-g. Alba ?, MAX IV and PRISMAS, model and actual opportunity?) –

NOT ONLY THEORETICAL TRAINING

A beamline at some existing synchrotron ? Joining groups at existing beamlines? Some small accelerators in selected countries?

Cost and Financing

Rough estimate: between 1 and 2 billion US$ over 20 years

SESAME: 90 million US$ (full solar-energy electric power, marginal saving from using BESSY1 injector)

Financing:

Necessarily participating countries. Even upper value of the estimate is affordable. International support could be possible (Development Banks, International Cooperation ?)

Possible mechanisms: Intergovernmental (CERN-like), Private (Consortium of participants, ESFR-like)

Where?

NOT SO IMPORTANT, FOR THE MOMENT BEING – SESAME EXPERIENCE

Main possibilities:

- Mexico – Possible because of already existing plans. Political complexity , (federal structure allows local decisions, but eventual decision by Federal government)

- Colombia – Present government supportive of science.

Royalties Law 2056 (Sept.30, 2020)

- Dominican Republic – A City of Knowledge project announced by the President (February 2021), not yet implemented

- Central America ?

What else, elsewhere?

Whatever the location, it must be a Latin American Synchrotron, located WITHIN the Great Caribbean

Possible problem: Opprtunity to establish in other countries some complementary facilities not only an option for intemediate time, but as a Regional System of small accelerators.

Belonging to a unique institution?

If part of a regional lab. they wouls be less dependent of national political fluctuations.

This point might be a not easy aspect of negotiations.

When?

Optimistic assumption: Project develops faster than similar projects.

LNLS, SESAME, AfLS: 10-15 yrs for first idea to decision

LNLS, SESAME: 10 yrs for decision to operation

AfLS: First idea nineties, Interim Steering Committee 2015, First governmental formal declaration of support: 2019 (Ghana, president Akufo Addo), triggering Benin, South Africa, Nigeria and Ivory Coast

Beginning of the thirties, Mid-thirties ?

More realistic: end of thirties

Which Kind of Synchrotron?

0- Technological developments have accelerated the transition from one generation to another
1- It must be 4th generation. Currently only MaxIV, ESRF and Sirius. Again SESAME case instructive.
2- Complementary to Sirius, which is a 3 Gev synchrotron

3- Higher energy? Lower energy? Perhaps 1.5 GeV could be a sound choice considering the areas of application of special interest for the region. Example of MAX IV?

Expected Results

Scientific development of the scientific community, integration of groups from different areas, strengthening of internationalization, increased access to other international facilities, advanced research, increase of publication number (perspective confirmed as attainable in the South by SESAME)

Technological and industrial development, Challenges of the construction and maintenance of the facility, and its beamlines, of the data analisis, Sirius example of CERN patents use. Possible fostering of new industries even for the construction.

Social and economical development. Research in sensible areas, food safety, circular economy, pharmaceutical, health (Cardiology, Neuronal degeneration, production of radioisotopes, biodiversity and molecular structure of plants,, medicine from natural products, tomography), soil análisis, nanomaterials for energy, biosensors for agriculture

,

Academic development. Doctorates, and broadening of the actual range of advanced teaching (less scientific inbreeding)

Political development. Science Diplomacy, Regional Integration

Connection with Similar Projects

AfLS – link through LAAAMP – Joint presentation at last-year World Science Forum in Cape Town, foreseen another joint presentation at UNGA78, possibility of joint training activities **but most important point possibility of advocacy for joint international support**
A case for UNESCO? A case for American agencies?

Balkan Project in Montenegro

Interregional cooperation, initially in training, long term on prospective research, and not necessarily limited to Africa and Latin America

A crucial Question

Does feasibility justify the necessary financial commitment?
and, make it justifiable for politicians and civil society?

Problem: Cost of opportunity, vis à vis social and educational problems of the region

Specific considerations :

Insufficient scientific education and development, cause of indirect costs

Social relevance of problems like: Natural risk, Environment, Food security, Contamination), Agriculture, Health

Political relevance: Biodiversity

General considerations:

Right of people to develop their capacities

Benefits of international integration

Easy Answers from a Politician and a Scientist

José Francisco Peña Gómez: "Citizens have an individual right to develop, which must be recognized as a fundamental factor for the transformation of a nation".

Bernardo Houssay (1967): "Science, technology and research are the basis of the health, welfare, wealth, power and independence of modern peoples. There are those who believe that scientific research is a luxury or an interesting but dispensable entertainment. Serious mistake, it is an urgent, immediate and unavoidable need to advance. The dilemma is clear: either science, technology and research are cultivated and the country is prosperous, powerful and advances; or it is not properly practiced and the country stagnates and regresses, lives in poverty and mediocrity. Rich countries are rich because they devote money to scientific and technological development. And poor countries remain so if they do not do so. Science is not expensive, ignorance is expensive."

Not-so easy Answers

Comparison with other public expenditures

Health: During the pandemic the BCIE (Central American Bank for Economic integration) gave $400 million to the 8 countries it refers to

Education: The argument of the cost of opportunity is rarely used to deny financing in this sector (Average LA: 4.6% GDP, against 0.6% Science)

Military expenditure: in 2021, in the Greater Caribbean $21.2 Billion, largest fraction: Mexico and Colombia (together $18.9 Billion, broadly justified by the fight to Narcotraffic, especially in the Mexican case), but still remaining countries expenditure is $2.3 Billion
(Source: Stockholm International Peace Research Institute, D. Lopes Da Silva et al.)

Cooperation –An Opportunity for US

Role of SLAC for Brazilian LNLS and for SESAME. Two different cases

House Resolution for SESAME: *Funding is intended to promote scientific excellence in the Middle East region and prevent the loss of scientific expertise that is holding back science education and research in the region.*

SESAME benefitted also from CERN and UNESCO support

Relevance for our case: Science Diplomacy, Latin America and Africa are strategically important for US, in particular after the pandemic (Vaccines issue), but also for several geopolitical reasons. Similar argument applies to EU.

Possible Forms for US Support

Direct support:

Consortium of institutions: 1Universities with important LA programs. Not always easy. Conflicting interests and priorities

2 Big accelerators – Some discussion started

3 Possible APS sponsorship

Political support:

Through Agencies. DOE ? NSF ? USAID ? Unlikely at individual level, but probably not if a Latin American focused program is put in place.

A Marshall Plan for Central America? Advocated, two years ago, by Hispanic law-makers - Main motivation: social problems. But what about the reasons behind these problems?

Through UN: – US rejoined UNESCO and agreed to contribute 150 M $ yearly for the arrears (intersection with mentioned direct support)

Cooperation - Other Possibilities

Development Funds. Nominally stable (2000—2020) about 1 billion US$, 35% decrease in real terms

IDB Regional Public Goods Program

Multilateral and bilateral cooperation

European Union: Central America – European Union Association Agreement, two Belgian ratifications missing

Program for CELAC Infrastructure

Commonwealth programs

Possible form: Matching Funds

What has been done

Seminars: Frascati Natl. Lab. Universities of Rome and of Calabria, University of Los Andes, Popular University of Cesar, Pedagogical and Technical University of Colombia, Coast University (Barranquilla), ICTP School on Synchrotron Light Sources and their Applications, Lawrence Berkeley Laboratory, Stanford SLAC, Polytechnical University Valencia, Center Nuclear Science and Technology (Tunis)

Workshops and Symposia: Central American Network of Researchers in Natural Sciences, Symposium on Megaprojects with Dominican Republic Ministry of Higher Education, Science and Technology, **Multivenue Symposium in six countries,** Food safety and Biodiversity (Trieste)

Conferences: El Paso-Ciudad Juárez (Purdue), 5th African Light Source Conference, World Science Forum

Meetings: International Scientific Council-Dominican Academy of Science, Visit to several national Delegations to UNESCO

Connection with LNLS and SESAME, and ICTP-ELETTRA

Establishment of a working group developed starting from the authors of the 2020 article, and of an Interim Executive Committee

Names of the Project, LAMISTAD, Latin American International Synchrotron for Technology, Analysis and Development or GCLSI

What is in the Pipeline

Creation of an Association (or Foundation) to promote the project, possibly in connection with RCN

Technical detailed article, and feasibility study

Diffusion of the project (Civil Society, Press, Private Sector, Politicians)

Realization of Training Workshops-Courses

Contact International Organizations (UNESCO, CARICOM, ISC, FAO,UNDP).

Goal: UNESCO resolution supporting GCS and AfLS

Strengthening contacts with SESAME, LNLS, European and Northern American synchrotrons

Strengthening interregional contacts with similar infrastructures or projects (Africa, Maghreb, Gulf, Eastern Europe, China)

Participation in the Science Summit at UNGA78, next September

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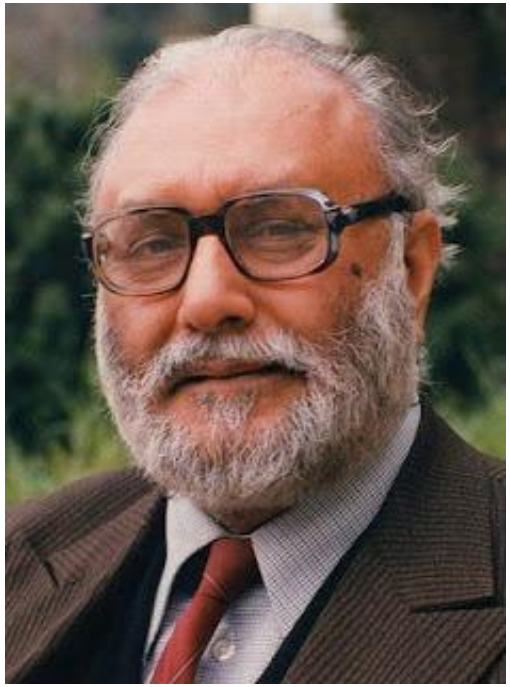


thank you
danke
謝謝
gracias
merci
obrigado
dziękuję
bedankt
go raibh maith agat
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kop khun krap
terima kasih
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Баярлалаа
dank je
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