

# Perspective on research–policy interface as a partnership: The study of best practices in CREATE

Adriana Banozic-Tang<sup>1</sup> and Araz Taeihagh<sup>1b 2,\*</sup>

<sup>1</sup>Yong Loo Lin School of Medicine, National University of Singapore, Dean's Office, 10 Medical Drive, Singapore 117597, Singapore and <sup>2</sup>Policy Systems Group, Lee Kuan Yew School of Public Policy, National University of Singapore, 469B Bukit Timah Road, Li Ka Shing Building, Level 2, #02-10, Singapore 259771, Singapore

\*Corresponding author. E-mail: [spparaz@nus.edu.sg](mailto:spparaz@nus.edu.sg)

## Abstract

This article serves as a blueprint and proof-of-concept of Singapore's Campus for Research Excellence and Technological Enterprise (CREATE) programmes in establishing effective collaborations with governmental partners. CREATE is a research consortium between Singapore's public universities and international research institutions. The effective partnership of CREATE partners with government stakeholders is part of its mission to help government agencies solve complex issues in areas that reflect Singapore's national interest. Projects are developed in consultation with stakeholders, and challenges are addressed on a scale that enables significant impact and provides solutions for Singapore and internationally. The article discusses the lessons learnt, highlighting that while research–policy partnerships are widespread, they are seldom documented. Moreover, effective communication proved to be a foundation for an effective partnership where policy and research partners were more likely to provide formal and informal feedback. Engaging policy partners early in the research co-development process was beneficial in establishing effective partnerships.

**Key words:** research–policy partnerships; CREATE; Singapore; research and development; international collaboration.

## 1. Research–policy partnerships

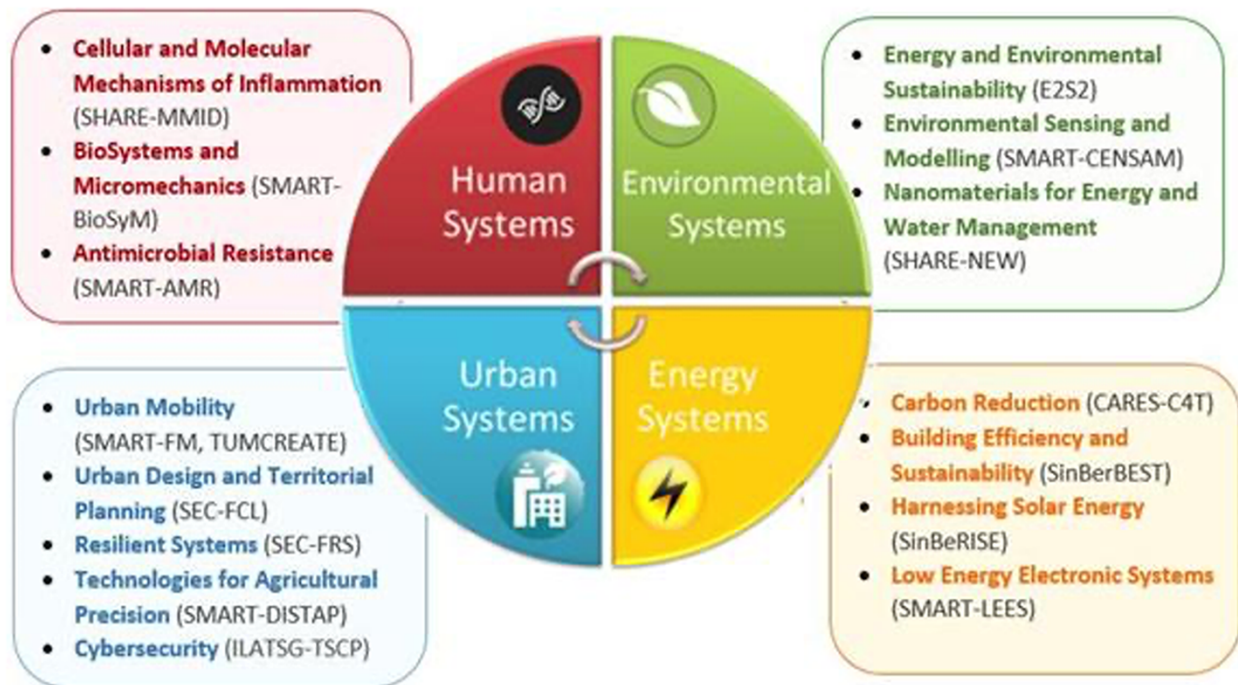
Research–policy partnerships represent an essential strategy for narrowing the gap between the academic and public sectors and facilitating the effective translation of knowledge into practice (Leino et al. 2018). This process relies on close communication and exchange between researchers and policy partners. The challenges often reported by these entities arise from differences in organizational cultures, a lack of trust, different operational time scales, and resources (Eriksson et al. 2014). The perspective of researchers is that policymakers' use of research is minimal, and, in turn, academics are perceived as being unlikely to use policymakers' insights to inform their research (McKee 2019). It is essential to recognize fundamental differences between these two communities; these include differences in incentive structures, timeframes for accomplishing their work, mechanisms for sharing information, professional training experiences, and measures for determining success (Martin et al. 2019). The research approaches used in understanding mechanisms of research–policy partnerships have included knowledge brokering (BEARS 2021), citizen science and participatory research. These approaches focus on joint understanding, co-development, and translation of knowledge and competencies between research and policy community. Overcoming the gap in understanding research–policy partnerships would require understanding and analysing processes, management, and leadership and would clarify the added value of implementing outcomes of the partnership (Bansal et al. 2012).

### 1.1 The case of Singapore

Singapore's commitment to and support of public universities is evident in the growth of investment in research and development (R&D), which reached 3.643 billion Singapore dollars in 2018 (Data.gov.sg 2020). The National Research Foundation (NRF) is spearheading Singapore's national R&D efforts and further drives research excellence in Research, Innovation, and Enterprise (RIE) 2025. RIE is a crucial part of Singapore's strategy to reinforce knowledge and innovation in the society and economy. RIE focuses on innovative technologies while understanding that in developing globally relevant leading digital solutions, there is a need to do more, especially to strengthen the translation of evidence into viable products and services that meet the needs of society (RIE 2021).

### 1.2 Development of the Campus for Research Excellence and Technological Enterprise

The Campus for Research Excellence and Technological Enterprise (CREATE) was established by the NRF in 2006 as part of a broader strategy to increase the vibrancy and diversity of Singapore's R&D ecosystem (RIE 2020). CREATE is a research consortium that comprises partnerships between Singapore public universities, the National University of Singapore and the Nanyang Technological University (NTU), and international research institutions. CREATE is an international research campus of institutional partnerships with leading academic institutions worldwide (the Massachusetts Institute of Technology (MIT), ETH Zurich, the University



Source: <https://www.create.edu.sg/research-areas>

**Figure 1.** CREATE's areas of research as described by the four major interdisciplinary themes.

Source: <https://www.create.edu.sg/research-areas>.

of Illinois at Urbana Champaign, Shanghai Jiao Tong University, the Hebrew University of Jerusalem, Technical University Munich, and the French National Centre for Scientific Research). Functioning as a knowledge hub, CREATE represents a unique research collaboration model. There are four main interdisciplinary thematic areas of research as part of the overarching theme of systems of systems: urban sustainability; the environment; energy; and human systems that reflect the national interests (see Fig. 1).

CREATE partners are expected to have a strong institutional commitment and strategic alignment and the desire to actively engage in the Singapore ecosystem in mutually beneficial ways for both Singapore and the home institution. CREATE programme are expected to be jointly developed and led by at least one Singaporean institution and one international partner at CREATE. Partners actively engage public agencies to address questions of national interest. Programme are developed in close consultation with the government and other stakeholders, who remain engaged and continue to shape the programme's research direction. Singapore agencies look to CREATE to find solutions to difficult R&D challenges. This study explores the elements and processes of successfully working with government agencies.

### 1.3 Evolving CREATE

CREATE was envisioned to be a distinctive part of Singapore's research ecosystem and an important element in each member institution's international research and innovation strategies. CREATE was to move beyond its original intent as a placeholder for international research collaborations and a crucible for building local research into a larger concept of being a symbol of Singapore's global significance as a research

hub for interdisciplinary and innovative research to solve real-world problems. CREATE's network development started with MIT, which has been present in Singapore since 1998. MIT has collaborated intensively with the government, and as part of CREATE, MIT focuses on identifying and carrying out research on critical problems of societal significance to Singapore (SMART 2021).

In announcing the Singapore–MIT Alliance for Research and Technology (SMART), Dr Tan (then Chairman of the NRF) acknowledged a decade-long relationship between the Singapore government and MIT along with its contributions to developing a vibrant academic ecosystem. In his words, 'our universities must embrace a culture of academic entrepreneurship, like MIT, to play an active role in contributing to Singapore's economic development' (NRF 2009). The strategic partnership between SMART and CREATE has greatly contributed to the success of CREATE. It has introduced new funding streams, insulated research centres from external economic circumstances, and ensured a focus on applied science and partnerships with industry, which helps further inform research (SMART 2021).

The second programme featured in this work is the Berkeley Education Alliance for Research in Singapore (BEARS), funded by the NRF of Singapore; BEARS was established in 2011 and developed as a centre for research, graduate education, and innovation. The mission of BEARS is to advance the design, modelling, and operating of building technologies in the tropical climate to ensure that these are both efficient and sustainable (SinBerBEST 2021). The programme is focused on commercialization, technology transfer, and closer collaboration with Singapore government agencies. Berkeley has a long track of engagement with Singapore's Building

and Construction Authority (BCA); on 16 November 2012, Berkeley Lab signed a Memorandum of Understanding with the BCA, establishing a framework for collaborative projects (BEARS and BCA 2021). The CEO of the BCA emphasized the importance of partnership with BEARS in accelerating knowledge translation that will bring environmentally sustainable building solutions to the market faster (BCA 2013).

This article highlights two case studies within BEARS and SMART programmes, featuring applied research in line with the priorities of the government stakeholders, which have resulted in the successful translation of knowledge between government agencies and the programmes.

### Examples of Successful CREATE Partnerships

**1. Visenti (SMART, Public Utilities Board):** The Wireless Water Sentinel project (WaterWiSe@SG) is a collaborative project involving the Center for Environmental Sensing and Modelling, part of SMART; the Singapore Public Utilities Board (PUB); and the Intelligent Systems Centre at the NTU. This project has been applied to (1) the usability of a low-cost wireless sensor network (real-time pressure and flow measurements); (2) remote detection systems for leaks and pipe bursts (even though they rarely happen in Singapore, these capabilities can significantly reduce maintenance costs and risks and can be extended for water conservation worldwide); and (3) monitoring of water quality parameters.

Visenti Pte Ltd, a spin-off company from the SMART Center for Environmental Sensing and Modelling, provides technology to support pipe network operators in monitoring infrastructure and optimizing operations. To help with water scarcity, the PUB has installed Visenti's WaterWise sensors island-wide to measure water quality and predict and detect leakages from bursts and leaking pipes. Visenti has developed a cloud-based service with Xylem (a US-based leading global water technology company) that will send alerts to any device via the internet. The PUB uses the updates to regulate water flow and pressure in the water network, reducing water losses and conserving resources.

Research–policy partnerships require a shared understanding of the methods used, leadership, effective communication, and the added value of implementing evidence (Leino et al. 2018). The collaboration with Visenti and PUB resulted from a trust-building exercise. The water monitoring system that evolved into Visenti was realized at the right time when PUB had a specific development plan, and administrative and other support had been extended to this project from PUB and the Management of SMART programme.

Initial engagement led by senior leadership was typically characterized by developing a research agreement or memorandum of understanding. Establishing trust included a series of engagements with varying degrees of formality that included joint brainstorming sessions where the research milestones and timeline were conceptualized. Operational teams led this part of the process. Both research programmes and teams from the government agencies were highly technically capable, and beyond the initial collaboration agreement decided at the strategic senior management level, every other aspect of collaboration was left to technical teams. Further engagements included discussions on secondments, exchange of staff from agencies to

the research programme and vice versa; these exchanges were crucial to evaluate details that can make or break the execution of a research programme, e.g. in developing computer simulation tool that can work on both systems, dealing with data security issues and data management issues.

**2. BCA Zero Energy Building Lab (BEARS, BCA):** Singapore Berkeley Building Efficiency and Sustainability in the Tropics (SinBerBEST) has partnered with the BCA to build a laboratory that showcases technologically advanced building technologies. This project is part of BCA's overall project to transform the existing Zero Energy Building (ZEB) to achieve Positive Energy Building (which uses a combination of renewable energy generation and energy efficiency to create more energy in their lifetimes than they consume). The research collaboration will see SinBerBEST's energy-efficient building technologies and solutions, such as a hybrid air-conditioning system, Power over Ethernet lighting, and power controls, being test bedded at BCA's ZEB at BCA Academy. Over 1,000 sensors and monitoring devices will also be installed to provide real-time data on the building's performance and its occupants' responses. The data collected will be fed into a smart building management system that adjusts air-conditioning, lighting, and power controls to optimize energy usage while providing a comfortable environment for its occupants. The ZEB currently has an overall energy surplus of 6–7 per cent.

When the technologies from SinBerBEST are incorporated, the overall energy efficiency is expected to improve by +20 per cent. The goal is to increase the energy surplus by 40 per cent. The design and deployment of multi-physical subsystems must be efficiently operated. BEARS focuses on providing sustainable technology solutions.

BCA's green building research collaboration with Berkeley Lab has expanded in scale and scope; it started with BCA's most significant research project—Asia's first ZEB—as a test bed for investigating building energy efficiency (BCA 2021). This project has played a key role in incorporating new technologies and will continue in its development.

Evolution of partnerships: partnerships, by default, are situated in a specific context—primarily creating value for Singapore and focusing on specific critical infrastructure issues (water systems and building technologies). The partnership had specific aims and was clearly defined mostly and was iterative at the same time. Arranging test bed sites, gathering data, and implementing findings are dynamic processes and have to be adjusted to external circumstances, e.g. weather conditions affect where and for how long researchers could use the specific test site. In addition, numerous brainstorming sessions and meetings on both ends (research and government agencies) helped enhance the understanding and clarify all aspects of the project, e.g. different researchers with different competencies would join in projects, including engineering staff that gave very specific insights. As project discussions progressed and both sides invested in project development and the first results started coming in, transparency and data sharing processes were established, and there was a joint sense of ownership and investment in the success of these projects.

## 2. Discussion and conclusions

These case studies highlight the key principles at play for improving the cooperation and exchange between science and policy actors. There is a need to further reinforce trust between these communities and remove logistics barriers to co-create and co-develop knowledge successfully. There is also the need for joint reflection and evaluation of implementation outcomes. The problem-driven iterative approach is perhaps a framework within which research–policy partnerships in CREATE can be analysed. Breaking up problems into their root causes, identifying entry points, searching for solutions, taking action, reflecting, adapting, and then acting again were steps that were part of the project development process and partnerships that were inalienable. We can say that the partnership evolution followed a trajectory of increased engagements and exchange.

There is also a need to develop, test, troubleshoot, and ultimately generate solutions specific to Singapore and Singapore-specific challenges. Scanning for needs in the policy sector requires an iterative process of troubleshooting and testing different solutions and provides feedback on how the implementation is going. Both the SMART and BEARS programmes were timely and addressed the immediate needs of the government agencies. As they focused on critical infrastructure (water systems and building technologies), technical counterparts in the government agencies side regularly communicated and helped establish test beds and data sharing systems. There is a lack of understanding of the typical timelines of policy processes versus research development, leading to differences in expectations of the outcomes, as the policy community is focused on producing immediate results pressured by public expectations and political election processes. The systematic study of success stories will be essential for moving beyond a focus on the obstacles and rather focusing on the process of gradual change—one that inspires hope and empowers scientists and decision-makers. The collaboration between SMART, NTU, and PUB has continued and further transformed into a spin-off. These principles will be applicable irrespective of the specific domain or the research programme, as seen in the example of CREATE.

Academic policy partnerships are a mechanism for realizing CREATE's vision of being a hub of research and innovation in Singapore, one to which Singapore agencies turn to seek solutions to difficult problems. Contextual factors contribute to shaping the research questions and their solutions—the synergy generated through multi-stakeholder collaboration that is contextually valuable to Singapore. Interpreting and disseminating research findings successfully requires building partnerships by fostering recognition and appreciation of stakeholders' different perspectives and competencies. Multi-agency collaboration could improve recruitment efforts and help to ensure that culturally and logistically appropriate research is being done. Partnership synergy could, over time, lead to higher quality and sustainability of research outcomes, developing new spin-off projects and programmes, as has been demonstrated in the Visenti case.

Particular elements of the process that have contributed to the partnership's success included a shared belief that knowledge translation is needed and that such translation is a way for the public sector to introduce innovation and fully embrace CREATE's mission to support Singapore agencies in the solving of critical challenges. Both programmes have had successful translation to the public sector and matured

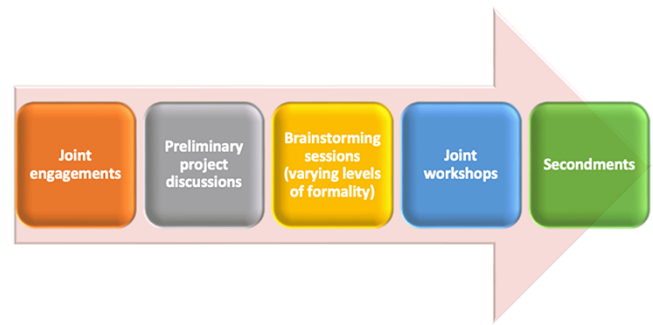


Figure 2. Partnership development evolution.

spin-offs to viable companies. Factors that contributed to the success of the partnership included: a shared understanding of the objectives of the partnership, established mechanisms of data exchange; product development; and implementation avenues. What has been observed in the case studies described here is the ripple effect of partnerships, where they either expanded partnerships within the same agencies or engaged the same government agency for a different project or where the government agencies expanded opportunities for engagement with academic organizations. PUB and BCA remained consistent government agency partners with different research programmes, including the Singapore ETH Centre and the Cambridge Centre for Advanced Research and Education. Research is typically designed to be effectively applied by the research and operational branches of the public sector, and the case studies illustrate that it is possible to integrate applied research and implementation into one synchronized process.

Developing a trusting research–policy partnership requires persistence and continuous investment. We can now recognize that key elements that have contributed to the success of research–policy partnerships in the two cases explored were: effective communication; a commitment to collaboration; shared values; technical capabilities on both the policy and the research side; and a commitment to follow through with the agreed outcomes. The partnerships aimed to achieve win-win situations. The benefits of technical competencies on both sides of the research–policy partnership (engineers in BCA and PUB) recognize the partnership's knowledge potential (see Fig. 2).

### 2.1 Lessons learnt and future directions

Further research is necessary to determine and establish elements that contribute to successful research–policy partnerships, as with CREATE. It is important to ask questions such as: what is the role of trust and principal investigators' experience and recognition of each other's competencies and interests? Are there elements of multi-stage collaborations? If so, how much do these elements contribute to reaching designated outcomes of research collaborations? Implementing measures to develop successful research–policy partnerships requires a joint understanding of the partnership objectives, a shared language of the concepts, and a commitment to following through with the actions. Bridging the gap is important because it helps research and governmental organizations facilitate actionable change that can directly and continuously feed innovation to the public sector in urban infrastructure, transportation, and biotechnology. Welcoming scientific research into the public sphere is not unique

but can clarify how science can inform policy and fill the research–practice policy gap.

Generalizable lessons below highlight elements and dynamics of research–policy partnerships in CREATE to deepen the debate on action points we can take to make them more effective.

- (1) The academic community should work with policy-makers and government agencies, addressing specific challenges that can be further broken down to be tackled incrementally.
- (2) Opportunities for continuous communication should be found, and communication with academics between R&D parts of government agencies should be encouraged.
- (3) Funding bodies and specialists can help facilitate this relationship and lead reflection and evaluation processes to understand what worked and what did not, how to move forward, where savings can be had, and identify early warning signs to prevent challenges to the partnership.
- (4) Co-develop questions together, engage early, and systematically address the concerns of government agencies, including clearances and how to manage data safely.
- (5) Ask questions of policymakers, such as what the problems are that they are trying to solve right now and how researchers can best help solve these problems.
- (6) More widely investigate relevant processes and involve the use of evidence and policy activities to inform decision-makers and disseminate these findings to help others.

## Funding

This research was supported by the Lee Kuan Yew School of Public Policy, National University of Singapore.

*Conflict of interest statement.* The authors declare no conflict of interest.

## Acknowledgements

A.B.-T. would like to acknowledge the support from Dr Tan Jen Jen and Prof. Lim Khiang Wee in facilitating the communication with programmes in CREATE. A.T. is grateful for the support provided by the Lee Kuan Yew School of Public Policy, National University of Singapore.

## Author contributions

A.B.-T. and A.T. have both contributed significantly to the research design, data analysis, and writing of the manuscript. A.B.-T. carried out the data collection.

## References

- Bansal, P., Bertels, S., Ewart, T., et al. (2012) ‘Bridging the Research-Practice Gap’, *Academy of Management Perspectives*, 26: 73–92.
- BCA. (2013), *Media Release BCA’s Breakfast Talk for CEOs: Making the Business Case for Green Buildings*. <<https://www1.bca.gov.sg/about-us/news-and-publications/media-releases/2013/09/12/bca-s-breakfast-talk-for-ceos-making-the-business-case-for-green-buildings>> accessed 18 Mar 2021.
- (2021), *BCA Singapore Seeks to Convert Its Flagship Zero Energy Building into a Positive Energy Building Using Smart Technologies*. <<https://opengovasia.com/bca-singapore-seeks-to-convert-its-flagship-zero-energy-building-into-a-positive-energy-building-using-smart-technologies/>> accessed 19 Mar 2021.
- BEARS. (2021), *Berkeley Education Alliance for Research in Singapore (BEARS)-ABOUT*. <<https://www.create.edu.sg/about-create/research-centres/bears>> accessed 6 Mar 2021.
- BEARS and BCA. (2021), *Berkeley Lab and Singapore’s Building and Construction Authority Collaborate on Testing Advanced Building Technologies | Berkeley Lab*. <<https://newscenter.lbl.gov/2012/11/19/singapore-bca-mou/>> accessed 7 Mar 2021.
- Data.gov.sg. (2020), *Research and Development Expenditure by Sector, Annual*. <[https://data.gov.sg/dataset/public-sector-research-and-development-expenditure?view\\_id=2bc53e77-3094-47a1-aae8-634bc6dea2d5&resource\\_id=7032cf7f-a9d6-4d3e-a819-4206b03a344a](https://data.gov.sg/dataset/public-sector-research-and-development-expenditure?view_id=2bc53e77-3094-47a1-aae8-634bc6dea2d5&resource_id=7032cf7f-a9d6-4d3e-a819-4206b03a344a)> accessed 19 Jun 2021.
- Eriksson, C., Fredriksson, I., Fröding, K., et al. (2014) ‘Academic Practice–policy Partnerships for Health Promotion Research: Experiences from Three Research Programs’, *Scandinavian Journal of Public Health*, 42: 88–95.
- Leino, H., Santaoja, M., and Laine, M. (2018) ‘Researchers as Knowledge Brokers: Translating Knowledge or Co-producing Legitimacy? An Urban Infill Case from Finland’, *International Planning Studies*, 23: 119–29.
- Martin, K., Mullan, Z., and Horton, R. (2019) ‘Overcoming the Research to Policy Gap’, *The Lancet Global Health*, 7: S1–2.
- McKee, M. (2019) ‘Bridging the Gap between Research and Policy and Practice: Comment on ‘CIHR health system impact fellows: Reflections on “driving change” within the health system’’, *International Journal of Health Policy and Management*, 8: 557.
- NRF. (2009), *NRF Announces Reappointment of Dr Tony Tan as Chairman for Its New Board and Launches the Construction Phase of CREATE* <<https://www.nas.gov.sg/archivesonline/data/pdfdoc/20090805004.htm>> accessed 19 Mar 2021.
- RIE. (2020), *RIE 2025 Press Release, Singapore Government Sustains Investments in Research, Innovation and Enterprise at about 1% of GDP for Next Five Years* <<https://www.nrf.gov.sg/docs/default-source/modules/pressrelease/rie2025-press-release.pdf>> accessed 18 Mar 2021.
- (2021), *The Research, Innovation and Enterprise (RIE) Ecosystem in Singapore*. <<https://www.nrf.gov.sg/about-nrf/rie-ecosystem>> accessed 5 2021.
- SinBerBEST. (2021), *Building Efficiency and Sustainability in the Tropics 2, 2017 to 2022* <<https://sinberbest.berkeley.edu/>> accessed 6 Mar 2021.
- SMART. (2021), *The Singapore-MIT Alliance for Research and Technology (SMART)-ABOUT*. <<https://smart.mit.edu/about-smart/about-smart>> accessed 7 Mar 2021.