DSN's Multi-stakeholder, Inclusive and Integrated Collaboration Framework for Sustainable Social Impact Research and Innovation in emerging market.

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Abstract

Data Science Network (DSN) is a non-profit based out of Nigeria that focuses its efforts on high impact research and capacity building of the next generation of African data scientists. The organization harnesses trans-disciplinary and transnational partnerships to create data driven solutions for public health, agriculture, public safety, education, inequality, among others. DSN's unique organizational structure hinges on the flow of connections and resources among its Knowledge Centres, Enabling Centres, Supporting Centres, and Catalyzing Centres. The results from the organization's unique model has won global awards from UNESCO, the Economic Computation Conference, and by the African Union as a reference point on home-grown African-centric approach to sustainable application of research practice to address social problems. The organizations structure and key performance indicators of DSN are discussed in this paper.

1 Introduction

Data Science Network (formerly known as Data Science Nigeria – DSN) is more than a research organization, it is a network that finds innovative ways to foster collaboration and capacity building that ensures access to cutting edge technologies and educational material while dedicating its research efforts to promote long-run sustainable growth in Africa. Since 2019, DSN has delivered over $7 million in high impact research-based solutions focused on applying machine learning to develop creative solutions to local problems that will generate benefits for years to come. To date, DSN has successfully leveraged its Nationwide Learners' Network across thirty-six cities in Nigeria and twelve African countries to launch six products, publish sixteen academic papers at leading conferences, mentor ten start-ups, deploy over three hundred machine learning talents for industry and provide free training for 500,000 students. It employs a unique model that ensures local input and relevance into the targeted solutions and capacity building that it provides.

The model that DSN utilizes attracts trans-disciplinary and transnational collaboration with top-flight local and international universities and research centers. For example, DSN recently secured a joint research funding worth CAD $1,248,145 with two universities in West Africa from the Canada's International Development Research Centre (IDRC) and the Swedish International Development Agency (SIDA) to focus on the application of Artificial Intelligence (AI) innovations in the area of education.DSN's ecosystem model is constantly evolving to ensure alignment with current national policies and strategic interventions. During the COVID-19 lockdown, DSN led the national advanced analytical team working for the Nigerian Governors Forum on the use of anonymous mobile phone call data to track lockdown effectiveness, identification of socio-economically vulnerable segment and tracking the disease spread pattern to inform robust intervention. This effort has metamorphosed

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into the current policy drive on the use of private=preserving mobile phone data for social good in Nigeria.

The next section of our paper will discuss DSN's unique model followed by the impacts of each of the centres that shape the organizations network and their targeted efforts. The paper concludes by summarizing DSNs organization, impacts, and future efforts.

2 DSN model

DSN started six years ago as a local intervention to scale up machine learning talent targeting research and industry readiness applications. Its unique value chain is such that it works in collaboration with various academic/research institutions, development agencies, government, and learners' communities across Africa. The structure is a radical departure from the traditional learning community and is built around four enablers in a dynamic collaborative ecosystem to create sustaining value for individuals and the industries within and outside the network. An overview of the DSN collaboration map is shown in figure 1 below.

The composition is used to illustrate the connections between different stakeholders within DSN. The organization operates using four centres: Knowledge, Enabling, Supporting, and Catalysing; that connect with invaluable stakeholders within Research and Development, Start-Up Support, and Fund Access / ROI in DSN.

The Knowledge Centres harness the expertise from leading universities, research institutes, and independent researchers to deliver high-impact data driven research in areas such as disease prevention to enhancing supply chains. The centre focuses on research collaboration that is enhanced through the DSN's connections with government, industry, and start-ups that ensures cutting edge research that addresses current and future challenges relevant to African society. The synthesis of research results feeds into conferences, academic papers, and Findable, Accessible, Interoperable and Reusable (FAIR) data that perpetuate the research cycle.

DSN leverages its connection with policy makers, regulators, and advocacy groups to maximize support to research efforts and start-ups. These efforts are directed through the Enabling Centres within the DSN community. The Centres maintain a close eye on developments in government incentives and policy and target this knowledge to facilitate research collaborations and start-ups. To date, the efforts by the Centre have improved market access, ensured stakeholders have complete policy information, and support the capacity building of the next generation of start-ups and researchers. The interactions with the stakeholders within the Enabling Centres feed into the Supporting Centres and Catalysing Centres to maintain a targeted approach to the content, of work education targets, and vision for future prospects.

Another key pillar of the DSN business model are its Supporting Centres. The Centres tap into DSN's connections with industry, investors (VC, Angels, Donors, etc.) and Tech Giants to drive innovation and ensure research collaborations develop relevant industry solutions. The access to funding supports scaling up deployment of products and research opportunities while extending the range of applications of the products. Furthermore, start-ups are able to access knowledge from industry leaders to improve solution implementation support, extend ideas-to-products, and find mentors that can support them during their journey.

The Catalyzing Centres serve as a hub that galvanizes the next generation of data driven researchers and start-ups. The centre acts a network where individuals can test their skills in a hackathon or pitch new ideas on research or start-ups. DSN connection with academics, successful start-ups, industry and the government ecosystem ensures that feedback is driven by robust evidence.

The extensive network that DSN has with industry leaders and organization within and outside of Africa ensure highly relevant research, philanthropy, and support to start-ups driving Africas technological transition. These impacts are discussed in the following section.

3 DSN impact

DSN's track record demonstrates its effectiveness in staying tapped into cutting edge research while maintaining an invaluable perspective on challenges and solutions that are relevant across Africa. The

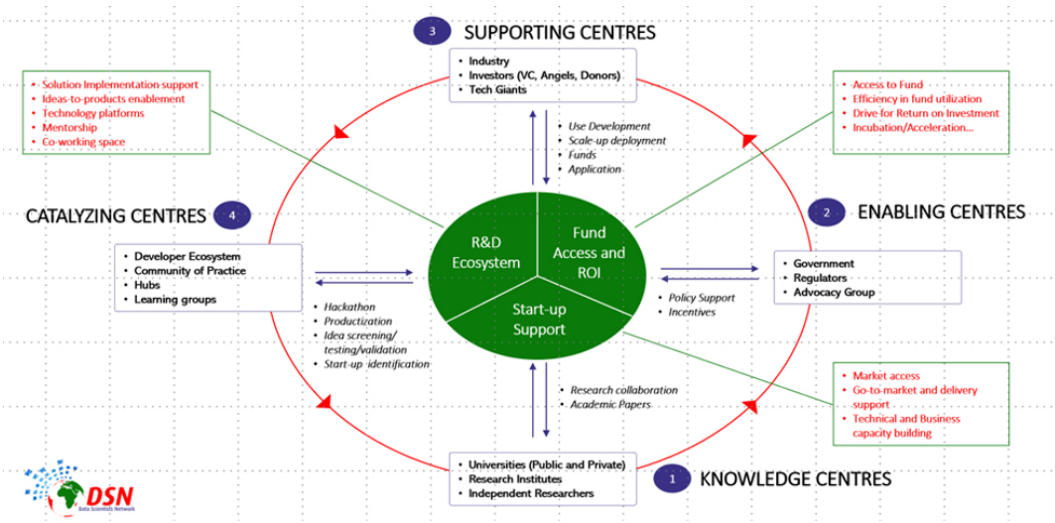

Figure 1: DSN model

organization's collaborations with leading institutes, academics, and governments in and outside of Africa, and their respective output, demonstrate DSNs value that is increasingly recognized globally.

The success of DSN's Knowledge Centre demonstrates the versatility, impact, and range of DSN machine learning and artificial intelligence through the research, applications, and the partnerships fostered along the way. Most recently, the centre has accomplished bringing in AI to support developments in the African education system (EduAIHub [2022]), enhancing malaria prevention (DSN [2018]), establishing FAIR principles for virus outbreak data (GoFair [2020]), publishing robust African COVID-19 data, reducing Nigerian police brutality (Nsoesie et al. [2021]), enhancing the Nigerian agricultural supply chain (Onwude et al. [2022]), and establishing real-time geospatial tracking of malaria treatment in Nigeria (Adekanmbi et al. [2020]). These efforts were made possible with DSN's ability to foster international collaborations through grant partnership, project participation with global research centres, and multi-institutional partnerships for long-term research. Additionally, the Centre enhanced the capacity of the next generation of data scientists through a student mentorship program, providing free access to the University of Nebraska's Masterclass on Game Theory, and by hosting the joint academic conference TOKI. The continued success of the DSN Knowledge Centre to promote sustainable growth across Africa hinges on its ability to seamlessly merge local perspectives into efforts that leverage the expertise of each party involved.

The Enabling Centres develop data driven solutions to challenges facing the Nigerian public sector. To date the Centres has developed innovations to reduce financial inequality (GRID3 [2019]), developed a data-driven decision platform for the Lagos State government (MEPB [2021]), and harnessed the power of crowdsourcing to collaboratively build a platform that prevents financial fraud among low-income people (Data Science Network [2019]). DSNs keen eye for local solutions while leveraging its international perspective guided the use of mobile call data records and geospatial analysis to utilize the increased use of cell phones regardless of smart capabilities. The efforts were directed to effectively predict COVID-19 spread, risk assessment, and identify vulnerable populations in Nigeria (Nigerias Governors Forum [2021]). DSN serves industry leaders such as the Central Bank of Nigeria, Lagos State Government, and MTN (mobile network operator) which allows the organization to tap into the data requirements and challenges of these industries and feed this information back into Start-up support and the R&D Ecosystem.

DSN's Supporting Centres' collaboration with the Mastercard Foundation, Microsoft, Chevron Nigeria, and Nvidia exemplify the organizations dedication to providing the next generation of data scientist and start-ups with the tools they need to succeed. DSNs collaboration with Mastercard developed AI-enabled SMS-powered learning platform supported 7 million students during the COVID-19 lockdown (Mastercard Foundation [2020]). The Deep Learning Bootcamp hosted by DSN in 2018 and 2019 provided free access to Microsoft's cloud computing platform Azure (Technext [2018], Techpoint [2019]), while their's collaboration with Chevron Nigeria and KPMG hosted

multiple hackathons to support the next generation of Nigerian data scientist to develop AI solutions for carbon reduction in the energy sector (The Guardian [2027], This Day [2021]. Thanks to NDVIDIa's donation of advanced workstations and free access to AI learning content, start-ups are able to access cutting edge technology and educational resources through DSN's Supporting Centres which continues to support these communities today (Techcabal [2022]).

The Catalyzing Centres within DSN provide a valuable resource for start-ups and young data scientist to access funding and capacity building events. Through a partnership with the Bill and Melinda Gates Foundation, DSN supports 12 start-ups focused on the use of AI for the social good. The support is through a central AI start-up hub in Lagos, Nigeria and allows the entrepreneurs to go through a thorough 90-day development cycle (Techeconomy [2021]). The Centre also promotes hackathons to support Pan-African machine learning among students to solve ongoing problems in Africa (UMOJA [2022]. Solution development workshops involving a tripartite partnership between DSN, Lagos Business School and South-African based Insight2Impact, focus on using public knowledge and hackathon sessions to address data for financial inclusion (Finmark Trust [2019]. The high impact DSN makes with the next generation of data scientist would not be possible without the generous financial support of industry leaders.

The dedication DSN has towards developing high-impact research and supporting the livelihoods of students and start-ups through trans-disciplinary partnerships and international collaborations is reflected in the outcomes of the organization by the international community. Two of DSN products are listed in the UNESCO/IRCAI Global Top 100 AI Products for Social Impact (Techeconomy [2022]. Additionally, DSN received the best academic poster at the 21st edition of the global Economic and Computation Conference and was in the top 48 finalist at the global Cognizant-sponsored competition on artificial intelligence-driven models to prescribe actions for safely reopening society and limiting economic impact while minimizing COVID-19 transmissions (Xprize [2020]). Furthermore, in 2019 DSN received the Matthai Impact Award at Deep Learning Indaba, which designated DSN as the top AI learning community and solution delivery network in Africa (Deep Learning INDABA [2019]).

4 Summary

DSN's various research outcomes and impact has been made possible through a collaborative network of learners and mentors ecosystem across the academia, industry, development agencies, government and research centers. The ability of DSN to harness transdisciplinary and transnational partnerships continues to develop high impact data driven solutions for public health, agriculture,public safety, education, inequality, among others. The impacts resulting from DSN's unique model have been recognized on the worlds stage by UNESCO ((IRCAI) [2020]), the Economic Computation Conference and has also been referenced by UNESCO Science report (Lewis et al. [2021]), World Economic Forum (World Economic Forum [2020]) and by the African Union as a reference point on home-grown African-centric approach to sustainable application of research practice to address social problems. DSNs future efforts will continue to refine its four Centres and expand collaboration to create data driven solutions that address societies biggest challenges.

References

Olubayo Adekanmbi, Wuraola Fisayo Oyewusi, and Ezekiel Ogundepo. Real-time crowdsourcing of health data in a low-income country: A case study of human data supply on malaria first-line treatment policy tracking in nigeria. In *CSW@ NeurIPS*, pages 14–18, 2020.

Data Science Network. Nalie, 2019. URL `https://www.datasciencenigeria.org/ai-commons-na-lie/`.

Deep Learning INDABA. Research excellence and impact in african artificial intelligence. https://bit.ly/3RseyWO, 2019.

DSN. Ai commons health and wellbeing hackathon solutions. `https://www.datasciencenigeria.org/ai-commons-malaria-classification/`, 2018.

EduAIHub. Artificial intelligence for education innovation research. `https://eduaihub.org/`, 2022.

Finmark Trust. Homegrown digital platforms create new opportunities for digital financial services and data science in nigeria. https://bit.ly/3fr1Haa, 2019.

GoFair. Second fair data point for covid-19 data installed in africa. `https://www.go-fair.org/2020/08/06/second-fair-data-point-for-covid-19-data-installed-in-africa/`, 2020.

GRID3. Demographics of financially included and excluded populations in nigeria. https://grid3.org/spotlight/demographics-of-financially-included-and-excluded-populations-in-nigeria, 2019.

(IRCAI). Ircai global top 100. https://ircai.org/global-top-100-outstanding-projects/results/, 2020.

Jake Lewis, Susan Schneegans, Tiffany Straza, et al. *UNESCO Science Report: The race against time for smarter development*, volume 2021. UNESCO Publishing, 2021.

Mastercard Foundation. 1 million disadvantaged school children to benefit from 'learn at home' project by data science nigeria/malezi in partnership with the mastercard foundation. https://nggovernorsforum.org/index.php/73-featured-news/1564-governors-mtn-partner-to-use-data-to-halt-spread-of-covid-19, 2020.

MEPB. Learning and continuous development. https://lagosmepb.org/lagos-launches-open-data-agenda-eko-360/, 2021.

Nigerias Governors Forum. Governors, mtn partner to use data to halt spread of covid-19. https://nggovernorsforum.org/index.php/73-featured-news/1564-governors-mtn-partner-to-use-data-to-halt-spread-of-covid-19, 2021.

Elaine Okanyene Nsoesie, Wuraola Fisayo Oyewusi, Opeyemi Osakuade, and Olubayo Adekanmbi. A comparative analysis of semi-supervised and self-supervised classification for labeling tweets about police brutality. 2021.

Daniel Onwude, Thomas Motmans, Kanaha Shoji, Roberta Evangelista, Joaquin Gajardo, Divine-favor Odion, Nnaemeka Ikegwuonu, Olubayo Adekanmbi, Soufiane Hourri, and Thijs Defraeye. Bottlenecks in nigeria's fresh food supply chain: What is the way forward? 2022.

Techcabal. Inside nvidia plans to develop africa's ai ecosystem. https://techcabal.com/2022/02/16/inside-nvidia-plans-to-develop-africas-ai-ecosystem/, 2022.

Techeconomy. Startupsdata science nigeria opens ai startup incubation, research hub in lagos. https://techeconomy.ng/2021/07/data-science-nigeria-opens-ai-startup-incubation-research-hub-in-lagos/, 2021.

Techeconomy. Startupsdsn's products among ircai/unesco global top 100 ai products for social impact. https://techeconomy.ng/2022/02/dsns-products-among-ircai-unesco-global-top-100-ai-products-for-social-impact/, 2022.

Technext. Microsoft sponsors data science nigeria's deep learning nigeria bootcamp in lagos. https://nggovernorsforum.org/index.php/73-featured-news/1564-governors-mtn-partner-to-use-data-to-halt-spread-of-covid-19, 2018.

Techpoint. Microsoft returns as sponsor for data science nigeria's artificial intelligence bootcamp. https://techpoint.africa/2019/11/11/microsoft-returns-as-sponsor-for-data-science-nigerias-artificial-intelligence-bootcamp-2019, 2019.

The Guardian. Kpmg offers internship to 10 data science nigeria hackathon participants. https://guardian.ng/technology/communications/kpmg-offers-internship-to-10-data-science-nigeria-hackathon-participants/, 2027.

This Day. Cnl, data science nigeria reward winners of ai hackathon. https://www.thisdaylive.com/index.php/2021/09/23/cnl-data-science-nigeria-reward-winners-of-ai-hackathon/, 2021.

UMOJA. Umoja hack africa 2023. https://umojahack.africa/sponsors$_and_partners/$, 2022.

World Economic Forum. 4 ways african governments can bridge the digital skills gap for a post-covid economic recovery. https://www.weforum.org/agenda/2020/06/4-ways-african-governments-can-bridge-the-digital-skills-gap-for-a-post-covid-economic-recovery/, 2020.

Xprize. Introducing 48 finalists. https://www.xprize.org/challenge/pandemicresponse/articles/pandemic-response-challenge-finalists, 2020.

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   (a) Do the main claims made in the abstract and introduction accurately reflect the paper's contributions and scope? [Yes]
   (b) Did you describe the limitations of your work? [N/A]
   (c) Did you discuss any potential negative societal impacts of your work? [No]
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