DATA TOOLS FOR THE CALIFORNIA BAY AREA: ACTIONABLE INTELLIGENCE FOR CITIES TO SUPPORT SDG ACHIEVEMENT

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THE CHALLENGE

Data is integral to target-setting and tracking SDG achievement over time. While much attention has been given to national-level measurement and reporting systems, such as the U.S. National Reporting Platform (NRP)[1], less has been done to determine how these types of activities might function at the city level.

60% of the global population will live in cities by 2030[2], so successful SDG localization will be a critical step towards the achievement of SDGs. This success will depend on the concerted leadership of cities and city networks to take local action towards the Global Goals.

For the past year, Stanford's Sustainable Urban Systems Initiative (SUS)[3] within the School of Engineering has been working with the Sustainable Development Solutions Network[4] and a variety of local stakeholders in the California Bay Area to test SDG localization strategies. SUS has identified this main challenge: **we need actionable intelligence at the city level to achieve the SDGs.**

SOLUTIONS

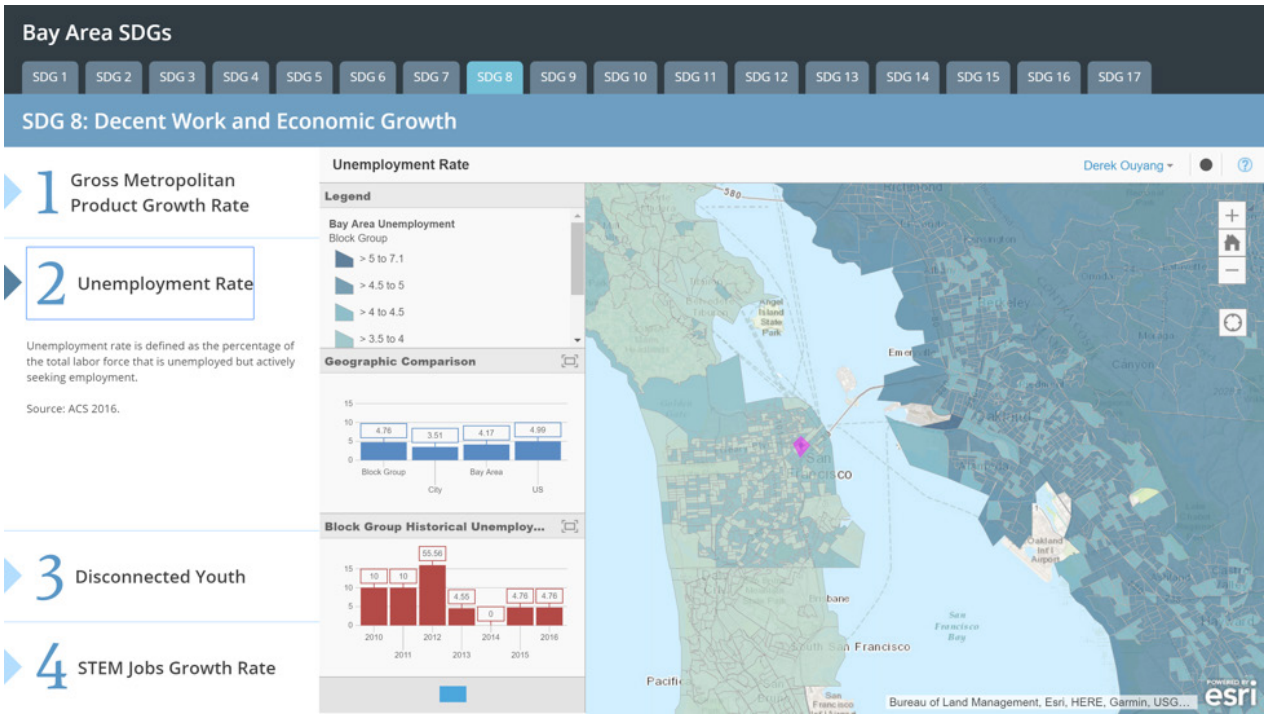
SUS is tackling the above challenge through the development of three solutions as shown in Table 1, starting in the California Bay Area. These solutions combine the best of top-down structure with bottom-up innovation to turn raw data (local reporting platform) into intelligence (dashboard) that is actionable (marketplace of decision-making tools) for counties, cities, businesses, and communities.

HOW IT WAS DONE

SUS has focused its preliminary work at the local level in the Bay Area to work toward each of the three solutions in the table above. The California Bay Area is one of the most dynamic and diverse regions in the world. The Bay Area has 9 counties and around 7.5 million residents. According to a report by the Association of Bay Area Governments, the region is growing and becoming more ethnically diverse every year, driven in no small part by an influx of international migrants seeking economic opportunity[5]. The Bay Area is also one of the most economically prosperous regions in the world, with a GDP that rivals some of the world's wealthiest nations[6]. While these factors have contributed to the Bay Area's cultural diversity and prosperity, it has also exacerbated some of the region's existing challenges. The Bay Area suffers from an inadequate level of housing and transportation infrastructure to support the growth it is facing, resulting in a crisis of affordability, inequality, as well as unsustainable land use and transportation patterns. Despite these challenges, the Bay Area as a whole performed well under the SDSN Cities SDG Index 2017[7], and in particular, the San Jose-Sunnyvale-Santa Clara metropolitan statistical area ranked number one on the list.

Table 1. Specific challenges identified by SUS team linked to theories of change and solutions. SUS has made preliminary progress in each of the three solution spaces below, which can be viewed at http://sus.stanford.edu/sdg.

Challenges	Theory of Change	Solutions	SUS's preliminary work on each solution
Data reporting is not standardized; data availability is limited; existing data is often locked in private sector	Data identification, collection, & storage needs to be standardized and centralized, ideally in nonprofit or academic sector	Build a local reporting platform	SUS developing specific indicators that could be used in a new local reporting platform
Data is difficult to interpret and understand, especially for stakeholders with low data literacy	Better visualizations and analytical tools must be developed to increase understanding across all stakeholders	Build an online data dashboard	SUS developing a Bay Area SDG Dashboard
Decision-making is highly specific to the different goals and contexts of different stakeholders; no one-size-fits-all tool	A decentralized "marketplace" is the most effective way for developers to build, test, and share data tools linked to the local reporting platform (LRP) and tailored to specific decision-making needs	Encourage the marketplace of decision-making tools	SUS developing a Story Map



SUS, in partnership with municipal leaders and community groups from the following three areas listed below, seeks to facilitate decision-making and asset management in a manner that aligns with the SDGs and addresses some of the Bay Area's chronic challenges:

- The City of San José (The Office of Mayor Sam Liccardo, The Office of District 3 Councilmember Raul Peralez, and the District 3 Community Leadership Council);
- The City of Palo Alto (Chief Sustainability Officer Gil Friend and Development Services Director Peter Pirnejad); and
- The City & County of San Francisco (Department of Planning, Chinatown Community Development Corporation).

Ultimately, this alignment will help move the Bay Area, and thereafter the world at large, towards a more sustainable, resilient and equitable future. The sections below outline the concept of each solution, and SUS's work to date on each.

LOCAL REPORTING PLATFORM

The SUS team synthesized its work with San José and stakeholder conversations with governments across the Bay Area and to recommend features for a unified local reporting platform. It is recommended that the Bay Area platform address the challenges of data identification, collection, and storage by providing a standardized set of indicators to report, and a streamlined way of reporting them. To begin, the SUS team is working with local stakeholders to establish which indicators can be feasibly collected and are meaningful and actionable on a local scale. Thus far these do not match exactly to the official SDG indicators, which have been set by the Inter-agency Expert Group on SDG Indicators[8], as these were developed with a focus on national-level reporting; ultimately, a local reporting platform requires that metrics be customized to local circumstances, policies and data users' needs. Based on a review of industry standards and stakeholder preferences, SUS proposes that to be most useful and effective, a local data platform should enable:

- Storing and facilitating queries on large amounts of data across a number of different formats and scales;
- Frequent updating as new data is added, in a way that is user-friendly for different types of stakeholders; tools or applications integrated with the database would need to automatically reflect updated data; and
- Sharing of data across different cities and the aggregation of local data into the NRP, to maximize integration and scalability.

Though SUS has not begun building this local reporting platform for cities and counties in the Bay Area, the US NRP is available online, is open-source and is designed to be replicated by other nations[9]; with some slight tweaks, the same reporting infrastructure can be adapted for local governments and ultimately integrated into the NRP.[10] As described by the Office of Management and Budget in conversations with SUS, such an integration would be limited to the indicators that are translatable across national and local scales, such as Census statistics, but can improve the NRP's aggregation/disaggregation functionality, thereby empowering local authorities to commit to and contribute best practices towards SDG achievement.

For this preliminary activity of indicator development, SUS reviewed all existing SDSN initiatives which have identified local SDG indicators, and curated its own limited set of indicators that satisfy the following criteria, outlined below. SUS believes these criteria are essential for local reporting to be sufficiently granular, frequent, and relevant:

- Data is available at the census tract level or lower;
- Data can be collected annually from 2015-2030;
- Indicator either (1) directly matches one of the official SDG indicators, (2) is in line with an existing SDG target with some limitations or slight difference, or (3) is not in line with an existing SDG target but is relevant to an SDG; and
- (Ideal) Data is available disaggregated by sex, age, and persons with disabilities.

In addition to about 20 useful indicators from the U.S. Census, American Communities Survey, and other sources, SUS identified "hyper-local indicators" (measurable at the block group level or lower) which have replicable methodologies and are relevant to the SDGs.

- **CO2 emissions per household, by block group.** The data and methodology for calculating this indicator are available for the Bay Area through Berkeley CoolClimate[11]. Estimated CO2 outputs are divided into several important emissions categories, such as transportation, housing, food, goods, and services. The different data categories included within this composite indicator serve multiple purposes; they are useful both for local governments to prioritize policies on local building code and public transit, as well for individual homeowners to understand and change their consumption patterns.

- **Vehicle miles traveled as a result of home-work commute, by block group.** Using LEHD Origin-Destination Employment Statistics (LODES)[12] and Google Maps Directions API[13], one can estimate the vehicle miles traveled (VMT) by both residents and workers who drive alone to and from individual block groups. While this dataset does not represent the complete transportation patterns of an urban system, it allows local governments to identify primary single occupancy vehicle use and pinpoint opportunities to incentivize mode shift to more sustainable modes of transit.

While these hyper-local indicators unlock practical local strategies at the scale of land use changes, economic development policies, and capital infrastructure projects, they are also still resource-intensive to construct and rely on many model-based estimations because of limited data availability. SUS' greatest lesson in reviewing local indicators has been, ironically, the significant value of national-level Census data, which is the most reliable data that can be disaggregated down to the neighborhood level. For this reason, it is more important than ever that the U.S. Census Bureau maintains and grows the federal resources it needs to collect and disaggregate data, especially statistics which align with the SDGs.

ONLINE DATA DASHBOARD

In order for people to use data, it needs to be communicated in such a way that motivates understanding, critical analysis and effective decision-making. Different types of data, and different stakeholders, demand different methods of communication. Determining the most effective way of communicating data requires significant user testing with both municipal leaders and private-sector organizations, including in communities with low data literacy.

Once a local reporting platform is developed for the Bay Area, it will have an online database of local SDG statistics which can be visualized using an online dashboard. As an interim solution for a comprehensive tool, SUS has built a preliminary Bay Area SDG Dashboard. To populate this model, the team collected its own set of preliminary SDG data for the Bay Area and is hosting it on Stanford University servers and an ArcGIS Online account.

The first version of the Bay Area SDG Dashboard presents individual choropleth maps by SDG indicator. The workflow requires first preparing map shapefiles in a desktop ArcMap software before uploading them onto an ArcGIS Online account. From there, additional visualization options have been tailored using the features available in tools like Operations Dashboard[14] to allow users to dynamically compare data across different spatial and temporal scales.

SUS is in the process of building a core set of visualization and interpretation tools that can serve as the foundational layer of interaction with the SDG data. For example, trendline graphs for individual indicators would plot all temporal measurements to date and extrapolate linear pathways towards 2030 representing business-as-usual (BAU) and alternative intervention scenarios, and may be useful for comparing different policy strategies. On the other hand, maps can better visualize inequities of outcomes across different geographies at the county, city, or neighborhood level and help prioritize specific places and communities of focus. But beyond these foundational methods of visualization and interpretation, what SUS has learned through its process is that there is no one-size-fits-all way to communicate SDG data. For example, CO2 emissions have split attributions between industry, government, and citizens, and each group has different strategies available to reduce their footprint, and thus, different data to focus on. It may ultimately be up to the broader community to build more specialized views for specialized needs, leading to the next solution space, described below.

EVALUATE THE MARKETPLACE OF DECISION-MAKING TOOLS

Representatives from the public and private sectors in San José, Palo Alto, and San Francisco have vocalized how they would benefit from a data tool operationalizing SDGs for their specific roles. Different stakeholder groups have the ability to act on the SDGs in different ways, in accordance to their institutional mandates and processes. The marketplace of data-focused decision-making tools is equally diverse to meet these varying needs. Not only are there different types of data filters and visualizations suitable for each stakeholder group, but there are also different tools or applications most helpful to each. Examples include: modeling software to support policy decisions, community engagement tools, and social apps that can incentivize behavior change through gamification strategies. Through interviews and design exercises with city staff, nonprofits, and businesses, the SUS team will develop tools that harness the power of SDG data and support decision-making to further progress toward SDG achievement.

The Esri Story Maps[15] tool has been used by local municipal authorities to help educate the public about local urban issues like flood vulnerability in San Francisco[16], which in turn helps inform the design of appropriate data-driven decision-making tools. As part of an ArcGIS Online license which is available to cities, nonprofits, and academic institutions, the tool allows the designer to embed specific maps into web interfaces with various levels of textual explanation and multimedia content, allowing the same information to be visualized by technical experts and by the general public. Story Maps are a great example of versatile applications that can populate the marketplace, as they demonstrate how stakeholders can pick and choose only the relevant data to tell a story that matters to their constituents. SUS has created an example Story Map which explains the purpose of the Bay Area SDG Dashboard, and is collaborating with individual neighborhood groups like District 3 in San José and the Chinatown Community Development Corporation in San Francisco to craft even more community-centered education and engagement tools using the Story Map interface. The experience working directly with citizens in these neighborhoods has emphasized the importance of empowering communities to shape their own stories organically over time, and has driven the adoption of accessible and flexible platforms like Esri.

STRENGTHS, WEAKNESSES, AND LESSONS

SDG data localization efforts follow a wealth of promising precedents. There are many successful city standardization and streamlining frameworks that have grown in popularity in recent years, including the City Resilience Framework by the Rockefeller Foundation and Arup[17], the ClearPath carbon accounting methodology by ICLEI - Local Governments for Sustainability[18], and the local data intermediaries of the National Neighborhood Indicators Partnership[19], etc., which demonstrate the willingness of, political advantages to, and practical gains for cities that share tools for action-able intelligence. Many local governments have also taken steps to open up their data for civic use and for user-friendly visualizations; examples include the Association of Bay Area Government's Resilience Open Data Portal[20] and UCLA's Energy Atlas for LA County[21]. And, organizations like Code for America[22] have demonstrated the potential for cities to unlock the creative talents of hacker communities and tech sector employees to apply their coding skills to supporting actionable intelligence using civic data. The Bay Area SDG Dashboard should emulate the successful networking campaigns of existing sustainability and resilience initiatives to build a clear value proposition for local governments, adopt best practices of data architecture from existing open data efforts, and host hackathons in the tech community to catalyze private-sector innovation in the marketplace of data-driven tools. All of these assets can be best captured through close engagement with academic institutions in the Bay Area, like Stanford.

Many types of data are still not easily accessible at the local scale. For example, data from the investor-owned utilities (IOUs) in California is notoriously difficult to acquire, in part due to a legal restriction which "requires [utility data] aggregation to include at least 15 service accounts from different customers and that no individual service account may account for 15% or more of the total energy usage."[23] While policies like these stem from legitimate privacy concerns, they also limit the ability of responsible local stakeholders to make evidence-based policies to achieve the SDGs. It may be possible for a private research institution like Stanford to acquire more granular data through specific research agreements with private corporations like IOUs.

Some local governments in the Bay Area are reticent about adopting the SDGs as an official local brand. This is due in part due to the lack of awareness in Bay Area communities about the SDGs, but more due to the fact that many cities, counties, and regional governments have very recently adopted their own visionary plans such as Envision San José 2040[24] and Plan Bay Area 2040[25]. It may be politically infeasible for mayors and city councils to go back to the drawing board and re-communicate sustainability goals to their constituents through a global framework. However, the marketplace framework is a practical way in which individual stakeholders can develop custom campaigns and tools with their own local branding, while still linking specific indicators and metrics to the database of the local reporting platform.

Academic institutions can serve as an anchor for SDG data efforts. Local governments through the region, from Stockton to San José, are severely understaffed and under-resourced and do not have the capacity to unlock the value of open data or develop data-driven tools in-house, let alone hire expensive consultants who would rather invest their time in the private sector. And even if governments were to have the resources to lead such efforts, the over 100 cities, 30 water agencies, and 20 transportation agencies are beholden to the interests of their own constituents and politically disincentivized to collaborate on regional issues, like those inherent in the SDGs. Academia is in a unique position to act as data manager, general convener and facilitator for the many stakeholders whose action will be necessary to ensure the achievement of the Sustainable Development Goals. SUS's work on localizing the SDGs has involved extensive needfinding with the local stakeholders mentioned, none of whom would have had time to lead the initiative themselves. Students and researchers have gathered a wealth of practical knowledge from both the public and private sector and benefited from the resources that Stanford has to offer, not the least of which has been its reputation as a neutral and objective partner to cities. Not only can SUS continue to serve as an anchor to SDG data efforts in the Bay Area, but its frameworks and the tools it has developed can be replicated by academic anchors in other urban centers in the US.

NEXT STEPS AND GUIDANCE FOR FUTURE ACTION

Developing data tools that provide actionable intelligence to the broad range of stakeholders in a city that can support SDG achievement requires these primary “first steps”:

- Cities should identify data champions in each of their departments who can identify and collect data that aligns with the SDGs to inform objective goal-setting at the next general plan or sustainability plan update.

- Cities should instruct internal GIS data specialists to develop scores for the hyper-local indicators described above.

- Cities should accelerate the establishment of open data platforms and reach out to local universities, entrepreneur networks, and nonprofits to organize hackathons and civic fellowships focused on improving local SDG achievement.

The models that SUS is building to demonstrate innovative SDG data localization tools that can be replicated in other cities are available here: http://sus.stanford.edu/sdg. SUS continues to expand these activities on new cities and counties, especially in the Bay Area, and developing new prototypes for the local reporting platform, dashboard, and marketplace of decision-making tools. More information about city-university collaboration through SDSN’s USA Sustainable Cities Initiative can be found here: http://unsdsn.org/what-we-do/solution-initiatives/usa-sustainable-cities-initiative-usa-sci/

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